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Environmental Protection Agency

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Office of Chemical Safety and
Pollution Prevention

# Data Quality Evaluation Information for General Population, Consumer, and Environmental Exposure for Butyl benzyl phthalate (BBP) (1,2-Benzenedicarboxylic acid, 1-butyl 2-(phenylmethyl) ester)

# Systematic Review Support Document for the Risk Evaluation

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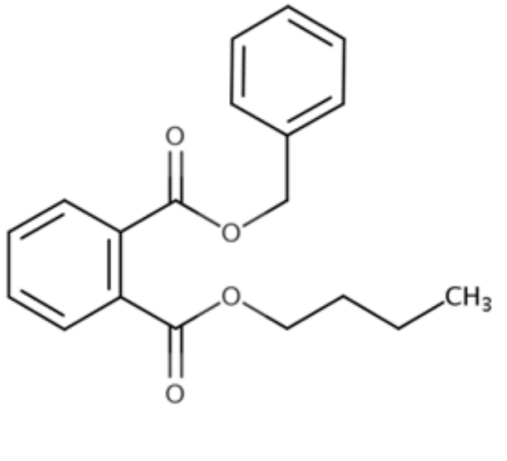


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This supplemental file contains information regarding the data quality evaluation results for data sources that met the PECO screening criteria for the *Consumer and Indoor Dust Exposure Assessment for Butyl benzyl phthalate (BBP)*, *Environmental Media and GenPop Screening for Butyl benzyl phthalate (BBP)*, *Biomonitoring Assessment for Butyl benzyl phthalate (BBP) (NHANES)*, and *Environmental Exposure Assessment for Butyl benzyl phthalate (BBP)*. EPA conducted data quality evaluation and extraction based on author-reported descriptions and results; additional analyses (e.g., statistical analyses) potentially conducted by EPA are not contained in this supplemental file. EPA performs data quality evaluation as a part of the TSCA systematic review process described in the *Draft Systematic Review Protocol Supporting TSCA Risk Evaluations for Chemical Substances*. The systematic review steps are further described in the *Risk Evaluation for Butyl benzyl phthalate (BBP) – Systematic Review Protocol*.

Additionally, the overall quality determination (OQD) for each reference represents the data as a whole for each evidence stream, not for individual scenarios described within a study. For example, a reference that has both monitoring and experimental data would have OQDs using the data quality evaluation metrics for monitoring and experimental data, respectively. An OQD utilizing the data quality evaluation metrics for monitoring data, or any other single evidence stream, would consider all data pertinent to that evidence stream in the reference. Acronyms and abbreviations used within this supplemental file are defined in the table at the end of this file. This supplemental file may also be referred to as BBP Data Quality Evaluation Information for General Population, Consumer, and Environmental Exposure.

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| **2149595** | Shen, L., Xia, B., Dai, X. (2013). Residues of persistent organic pollutants in frequently-consumed vegetables and assessment of human health risk based on consumption of vegetables in Huizhou, South China. Chemosphere 93(10):2254-2263. | **683** |
| **2215411** | Fromme, H., Lahrz, T., Kraft, M., Fembacher, L., Dietrich, S., Sievering, S., Burghardt, R., Schuster, R., Bolte, G., Völkel, W. (2013). Phthalates in German daycare centers: Occurrence in air and dust and the excretion of their metabolites by children (LUPE 3). Environment International 61:64-72. | **684** |
| **2215665** | Shin, H. M., Mckone, T. E., Nishioka, M. G., Fallin, M. D., Croen, L. A., Hertz-Picciotto, I., Newschaffer, C. J., Bennett, D. H. (2014). Determining source strength of semivolatile organic compounds using measured concentrations in indoor dust. Indoor Air 24(3):260-271. | **685** |
| **2345931** | Qian, H., Chen, M., Kransler, K. M., Zaleski, R. T. (2015). Assessment of chemical coexposure patterns based upon phthalate biomonitoring data within the 2007/2008 National Health and Nutrition Examination Survey. Journal of Exposure Science & Environmental Epidemiology 25(3):249-255. | **686** |
| **2347101** | Frederiksen, H., Kuiri-Hänninen, T., Main, K. M., Dunkel, L., Sankilampi, U. (2014). A longitudinal study of urinary phthalate excretion in 58 full-term and 67 preterm infants from birth through 14 months. Environmental Health Perspectives 122(9):998-1005. | **687** |
| **2501495** | Sakhi, A. K., Lillegaard, I. T., Voorspoels, S., Carlsen, M. H., Løken, E. B., Brantsæter, A. L., Haugen, M., Meltzer, H. M., Thomsen, C. (2014). Concentrations of phthalates and bisphenol A in Norwegian foods and beverages and estimated dietary exposure in adults. Environment International 73:259-269. | **688** |
| **2914665** | Myridakis, A., Fthenou, E., Balaska, E., Vakinti, M., Kogevinas, M., Stephanou, E. G. (2015). Phthalate esters, parabens and bisphenol-A exposure among mothers and their children in Greece (Rhea cohort). Environment International 83:1-10. | **689** |
| **2919757** | Enault, J., Robert, S., Schlosser, O., de Thé, C., Loret, J. F. (2015). Drinking water, diet, indoor air: Comparison of the contribution to environmental micropollutants exposure. International Journal of Hygiene and Environmental Health 218(8):723-730. | **690** |
| **3454652** | Wei, W., Mandin, C., Blanchard, O., Mercier, F., Pelletier, M., Le Bot, B., Glorennec, P., Ramalho, O. (2017). Predicting the gas-phase concentration of semi-volatile organic compounds from airborne particles: Application to a French nationwide survey. Science of the Total Environment 576(Elsevier):319-325. | **691** |
| **4164912** | Muenhor, D., Moon, H. B., Lee, S., Goosey, E. (2018). Organophosphorus flame retardants (PFRs) and phthalates in floor and road dust from a manual e-waste dismantling facility and adjacent communities in Thailand. Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 53(1):79-90. | **692** |
| **4165791** | Pelletier, M., Bonvallot, N., Ramalho, O., Mandin, C., Wei, W., Raffy, G., Mercier, F., Blanchard, O., Le Bot, B., Glorennec, P. (2017). Indoor residential exposure to semivolatile organic compounds in France. Environment International 109:81-88. | **693** |
| **4167514** | Quintana-Belmares, R. O., Krais, A. M., Esfahani, B. K., Rosas-Pérez, I., Mucs, D., López-Marure, R., Bergman, Å., Alfaro-Moreno, E. (2018). Phthalate esters on urban airborne particles: Levels in PM10 and PM2.5 from Mexico City and theoretical assessment of lung exposure. Environmental Research 161:439-445. | **694** |
| **4728899** | Weiss, J. M., Gustafsson, Å., Gerde, P., Bergman, Å., Lindh, C. H., Krais, A. M. (2018). Daily intake of phthalates, MEHP, and DINCH by ingestion and inhalation. Chemosphere 208:40-49. | **695** |

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|---|---|---|
| **5017615** | Okeme, J. O., Nguyen, L. V., Lorenzo, M., Dhal, S., Pico, Y., Arrandale, V. H., Diamond, M. L. (2018). Polydimethylsiloxane (silicone rubber) brooch as a personal passive air sampler for semi-volatile organic compounds. Chemosphere 208:1002-1007. | **696** |
| **5039996** | Chen, Y., Jiang, L., Lu, S., Kang, L., Luo, X., Liu, G., Cui, X., Yu, Y. (2019). Organophosphate ester and phthalate ester metabolites in urine from primiparas in Shenzhen, China: Implications for health risks. Environmental Pollution 247:944-952. | **697** |
| **5043338** | Velázquez-Gómez, M., Hurtado-Fernández, E., Lacorte, S. (2019). Differential occurrence, profiles and uptake of dust contaminants in the Barcelona urban area. Science of the Total Environment 648:1354-1370. | **698** |
| **5043469** | Al Qasmi, N. N., Al-Thaiban, H., Helaleh, M. I. H. (2019). Indoor phthalates from household dust in Qatar: Implications for non-dietary human exposure. Environmental Science and Pollution Research 26(1):421-430. | **699** |
| **5043472** | Wei, W., Mandin, C., Blanchard, O., Mercier, F., Pelletier, M., Le Bot, B., Glorennec, P., Ramalho, O. (2019). Semi-volatile organic compounds in French dwellings: An estimation of concentrations in the gas phase and particulate phase from settled dust. Science of the Total Environment 650 Pt. 2:2742-2750. | **700** |
| **5412073** | Giovanoulis, G., Nguyen, M. A., Arwidsson, M., Langer, S., Vestergren, R., Lagerqvist, A. (2019). Reduction of hazardous chemicals in Swedish preschool dust through article substitution actions. Environment International 130:104921. | **701** |
| **5469670** | Luongo, G., Oestman, C. (2016). Organophosphate and phthalate esters in settled dust from apartment buildings in Stockholm. Indoor Air 26(3):414-425. | **702** |
| **5532759** | Promtes, K., Kaewboonchoo, O., Kawai, T., Miyashita, K., Panyapinyopol, B., Kwonpongsagoon, S., Takemura, S. (2019). Human exposure to phthalates from house dust in Bangkok, Thailand. Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 11(13):1-7. | **703** |
| **5550408** | Weiss, J. M., Gustafsson, Å., Gerde, P., Bergman, Å., Lindh, C. H., Krais, A. M. (2018). Daily intake of phthalates, MEHP, and DINCH by ingestion and inhalation. Chemosphere 208:40-49. | **704** |
| **5750962** | Lee, I., Alakeel, R., Kim, S., Al-Sheikh, Y. A., Al-Mandeel, H., Alyousef, A. A., Kho, Y., Choi, K. (2019). Urinary phthalate metabolites among children in Saudi Arabia: Occurrences, risks, and their association with oxidative stress markers. Science of the Total Environment 654:1350-1357. | **705** |
| **6815879** | Kim, J. H., Kim, D., Moon, S. M., Yang, E. J. (2020). Associations of lifestyle factors with phthalate metabolites, bisphenol A, parabens, and triclosan concentrations in breast milk of Korean mothers. Chemosphere 249:126149. | **706** |
| **6815979** | SUNY, (2019). Semi-volatile organic compounds in infant homes: Levels, influence factors, partitioning, and implications for human exposure. Environmental Pollution 251:609-618. | **707** |
| Glossary of Select Terms for Data Evaluation Tables | | **708** |

**Study Citation:** Vethaak, A. D., Lahr, J., Schrap, S. M., Belfroid, A. C., Rijs, G. B. J., Gerritsen, A., De Boer, J., Bulder, A. S., Grinwis, G. C. M., Kuiper, R. V., Legler, J., Murk, T. A. J., Peijnenburg, W., Verhaar, H. J. M., De Voogt, P. (2005). An integrated assessment of estrogenic contamination and biological effects in the aquatic environment of The Netherlands. Chemosphere 59(4):511-524.

**HERO ID:** 70054

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | map and sampling details included |
| | Metric 2: | Analytical Methodology | Low | "An extensive description of all the methods andmaterials used in our study is provided by Vethaaket al. (2002, in press). Vethaak, A.D., Schrap, M., de Voogt, P. (Eds.), in press."Estrogens and xeno-estrogens in the aquatic environment:an integrated approach for field monitoring and effectassessment. SETAC Technical Publications Series. SETACPress, Pensacola. |
| | Metric 3: | Biomarker Selection | N/A | the study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Netherlands |
| | Metric 5: | Currency | Low | 1999 |
| | Metric 6: | Spatial and Temporal Variability | Critically Deficient | sample size not reported, might be in the Vethaak 2002 paper |
| | Metric 7: | Exposure Scenario | Medium | municipal WW, effluent, industrial WW, rainwater, surface water, suspended water, sediment, bream muscle, flounder muscle |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | range and median provided |
| | Metric 9: | Quality Assurance | Medium | quality not discussed, but no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | variability and uncertainty not discussed, but no obvious concerns |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Xie, Z., Ebinghaus, R., Temme, C., Caba, A., Ruck, W. (2005). Atmospheric concentrations and air-sea exchanges of phthalates in the North Sea (German Bight). Atmospheric Environment 39(18):3209-3219. |
| **HERO ID:** | 102787 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Describes water and air sample collection through pump and filter. These methods are based on previous, cited studies. |
| | Metric 2: | Analytical Methodology | Medium | Discusses extraction, clean-up, chemical analysis, and gas chromatogram-mass spectrometry methods in detail. Includes recoveries, detection limit reported as range not for each chemical. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | North Sea (German Bight). Includes map of sampling stations |
| | Metric 5: | Currency | Low | 2004 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 11 water samples (replicates not specified) and 3 air samples collected in duplicate |
| | Metric 7: | Exposure Scenario | High | Phthalates are known to be toxic/endocrine disruptors and leached in the environment. Here, phthalates were measured in the atmosphere and sea water in the North Sea |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | raw data of phthalate concentrations in air and sea water provided with averages and standard deviations |
| | Metric 9: | Quality Assurance | High | "Matrix spikes, breakthrough check, field blanks, and method detection limits (MDLs) were applied for quality assurance and control purposes." Included laboratory and field blanks to quantify possible contamination. Discuss recoveries, which averaged >75% |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | include uncertainty analysis, air-sea vapor fluxes and errors, and mention a limitation |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Reddy, B. S., Rozati, R., Reddy, S., Kodampur, S., Reddy, P., Reddy, R. (2006). High plasma concentrations of polychlorinated biphenyls and phthalate esters in women with endometriosis: A prospective case control study. Fertility and Sterility 85(3):775-779. |
| **HERO ID:** | 150675 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Sampling methodology described in terms of sampling equipment, procedures, sample storage conditions and study site. Insufficient information regarding duration of sample storage prior to analyses. |
| | Metric 2: | Analytical Methodology | Low | Low. Analytical methodology described and referenced in terms of extraction, and analytical instrumentation. Insufficient information regarding instrument calibration, recoveries, and limits of detection. |
| | Metric 3: | Biomarker Selection | N/A | N/A. Sampling for parent chemicals of interest within biological media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Samples provided by participants in Andhra Pradesh, India. |
| | Metric 5: | Currency | Low | Low. Infertile couples for study screened for infertility between 1999 and 2005. |
| | Metric 6: | Spatial and Temporal Variability | Low | Low. Samples provided by 85 women with endometriosis and 135 control women. Temporal variability limited as single blood samples from each participant. Concern for timing of sample and adequacy of single sample representing the exposure concentrations responsible for outcome of interest due to short phthalate half-lives in blood samples. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Exposure source and population described in narrative text section detailing recent intense increase in industrialization, urbanization and lifestyle, diet changes in Andhra Pradesh area of India. Insufficient information regarding occupation of participants. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Low. Summary statistics of phthalate concentrations reported in terms of mean and standard deviation. Insufficient information regarding range of concentrations, frequency of detection in samples, number of samples in data set and raw data. |
| | Metric 9: | Quality Assurance | Low | Low. Quality assurance procedures not directly discussed, however can be assumed through use of standard analytic methodology referenced (Burce et al., 1994; Rozati et al., 2002). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Low. Summary statistics report concentration standard deviation, however discussion of study limitations lacking. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Hines, E. P., Calafat, A. M., Silva, M. J., Mendola, P., Fenton, S. E. (2009). Concentrations of phthalate metabolites in milk, urine, saliva, and serum of lactating North Carolina women. Environmental Health Perspectives 117(1):86-92. |
| **HERO ID:** | 194817 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | pilot study for EPA methods Advancement for Milk Analysis; IRB approval; collection described |
| | Metric 2: | Analytical Methodology | High | methods and instruments described; LOD and LOQ provided; performed the preparation of standard solutions, quality control (QC) verification, sample preparation, and instrumental analyses as previously described (Calafat et al. 2004) |
| | Metric 3: | Biomarker Selection | High | Various matrix types collected. Metabolite measurement in urine is particularly known to be well correlated to phthalate exposures. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | U.S. |
| | Metric 5: | Currency | Low | 2004-2005 |
| | Metric 6: | Spatial and Temporal Variability | Medium | (visit 1 milk samples, n = 18; visit 2 milk samples, n = 20; visit 1 other fluids, n = 33; visit 2 other fluids, n = 30; no replicates mentioned |
| | Metric 7: | Exposure Scenario | High | human biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | 10th, 25th, median, 75th, 90th, 95th percentile provided |
| | Metric 9: | Quality Assurance | Medium | quality control (QC) verification |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | variability and uncertainty not described, no obvious concerns |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Hwang, H. M., Park, E. K., Young, T. M., Hammock, B. D. (2008). Occurrence of endocrine-disrupting chemicals in indoor dust. Science of the Total Environment 404(1):26-35. |
| **HERO ID:** | 198203 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some information, such as vacuum model not reported. |
| | Metric 2: | Analytical Methodology | Medium | Some analytical methods not reported, such as recovery samples. LOD reported as range and not each chemical. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Davis, California |
| | Metric 5: | Currency | Low | Data collected in 2004 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 11 samples. No replicates collected |
| | Metric 7: | Exposure Scenario | High | Indoor dust in apartments and community hall |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Individual points reported. Summary statistics reported. |
| | Metric 9: | Quality Assurance | Low | QA/QC not reported but implied |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No gaps nor limitations reported. No characterization of variability. |

## Overall Quality Determination Medium

**Study Citation:** Rudel, R. A., Brody, J. G., Spengler, J. D., Vallarino, J., Geno, P. W., Sun, G., Yau, A. (2001). Identification of selected hormonally active agents and animal mammary carcinogens in commercial and residential air and dust samples. Journal of the Air and Waste Management Association (1990-1992) 51(4):499-513.

**HERO ID:** 198234

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | No major deficiencies identified. |
| | Metric 2: | Analytical Methodology | High | No major methodological deficiencies identified. |
| | Metric 3: | Biomarker Selection | N/A | No biomarker data identified. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Massachusetts |
| | Metric 5: | Currency | Low | Timing of sample collection for monitoring data is not reported, discussed, or referenced however publication year, 2001, is used as surrogate for sampling year. |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicates and <10 samples |
| | Metric 7: | Exposure Scenario | High | No major deficiencies identified. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data provided |
| | Metric 9: | Quality Assurance | High | No major deficiencies identified. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | No gaps nor limitations reported |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Huang, H., Ou, W. H., Wang, L. S. (2006). Semivolatile organic compounds, organochlorine pesticides and heavy metals in sediments and risk assessment in Huaihe River of China. Journal of Environmental Sciences 18(2):236-241. |
| **HERO ID:** | 359918 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methods and materials reported. Location of sampling stations Fig 1; sediment collected using stainless steel dredge; duplicate samples taken; 20-g freeze-dried and homogenized. |
| | Metric 2: | Analytical Methodology | Medium | Analytical methods and instrument reported. Extracted by acetone: n-hexane using Soxhlet; GC coupled with FID and ECD dectector (p.237); used blanked filters as controls; recoveries conducted, although individual recoveries not reported; LOD was 0.025-0.130 ug/mL. |
| | Metric 3: | Biomarker Selection | N/A | Study conducted in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study conducted in Jiangsu reach of Huaihe River, China. |
| | Metric 5: | Currency | Low | Sampling conducted in summer 2002. |
| | Metric 6: | Spatial and Temporal Variability | Low | Samples taken during summer when river flow was high. There were three sampling stations with duplicate samples taken at each. |
| | Metric 7: | Exposure Scenario | High | The study sampled a polluted river in China that is heavily populated with rapidly developing industrial and agricultural activities. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 1 presents mean concentration by study location. Raw data not reported. |
| | Metric 9: | Quality Assurance | High | Recoveries ranged from 56% to 113%; most relative std are <15%; control samples used; samples measured in triplicate. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability accounted by different locations sampled. Uncertainty not discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Zeng, F., Lin, Y., Cui, K., Wen, J., Ma, Y., Chen, H., Zhu, F., Ma, Z., Zeng, Z. (2010). Atmospheric deposition of phthalate esters in a subtropical city. Atmospheric Environment 44(6):834-840. |
| **HERO ID:** | 388076 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling equipment and methods are described in excellent detail and are scientifically sound. |
| | Metric 2: | Analytical Methodology | Medium | Analytical instrumentation and methods are described in excellent detail and are scientifically sound. However, instrumental detection limit for the chemical of interest is not reported, but rather a range of limits for all analytes. |
| | Metric 3: | Biomarker Selection | N/A | This study is testing for the parent chemical of interest in an environmental medium. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | 2007-2008 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Three sites were sampled for air twice weekly for a year. Unclear if there are replicates. |
| | Metric 7: | Exposure Scenario | High | Air samples were taken from locations that were relatively isolated from traffic and other ground-level disturbances. Each study site was characterized as urban or suburban within a subtropical city. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data are not reported; summary statistics include the minimum, maximum, median, and mean concentrations. |
| | Metric 9: | Quality Assurance | High | QA/QC methods included use of procedural blanks and surrogate standards. Recoveries for analytes and for surrogates were within acceptable range, and concentration determinations were adjusted to correct for recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Relative standard deviation for all analytes are reported and temporal variability is evaluated at the bulk level. Uncertainty in bulk deposition measurements related to sampling methods is acknowledged. Variation in season analyzed. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Gasperi, J., Garnaud, S., Rocher, V., Moilleron, R. (2008). Priority pollutants in wastewater and combined sewer overflow. Science of the Total Environment 407(1):263-272. |
| **HERO ID:** | 473432 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | sites described thoroughly but sampling methodology not discussed in detail. No description of sampling equipment or storage conditions |
| | Metric 2: | Analytical Methodology | High | LOQ provided; parameters were measured in accordance with standard French methods; Analyses were performed by a laboratory certified by the French Ministry of the Environment |
| | Metric 3: | Biomarker Selection | N/A | water |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | France |
| | Metric 5: | Currency | Low | published 2008 |
| | Metric 6: | Spatial and Temporal Variability | Medium | dry (n=10) and wet weather flows (n=13). No replicates. Samples were mixed for dry and wet due to no spatial differences. |
| | Metric 7: | Exposure Scenario | Medium | water around Paris |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | median, min, max, frequency of occurrence |
| | Metric 9: | Quality Assurance | Medium | for quality control: the COFRAC calibration certificate but not detailed |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and Uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Palmquist, H., Hanaeus, J. (2005). Hazardous substances in separately collected grey- and blackwater from ordinary Swedish households. Science of the Total Environment 348(1-3):151-163. |
| **HERO ID:** | 508379 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | sampling described, diagram included |
| | Metric 2: | Analytical Methodology | Medium | accredited contract laboratory, LOD included (table 6), no instrument details- may be detailed in lab reference |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sweden |
| | Metric 5: | Currency | Low | 2004 |
| | Metric 6: | Spatial and Temporal Variability | Medium | No. of samples: greywater 4, blackwater 3. Unclear if there are replicates. |
| | Metric 7: | Exposure Scenario | Medium | greywater and blackwater in households |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | average, min, max. Individual points not reported. |
| | Metric 9: | Quality Assurance | Low | quality assurance not discussed, no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Temporal variation analyzed (fig 4). There is mention of budget limitations. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Peters, R. J. B., Beeltje, H., van Delft, R. J. (2008). Xeno-estrogenic compounds in precipitation. Journal of Environmental Monitoring 10(6):760-769. |
| **HERO ID:** | 510316 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology is sufficiently detailed. |
| | Metric 2: | Analytical Methodology | High | LOD is present. Analytical methodology is sufficiently detailed. |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The Netherlands. |
| | Metric 5: | Currency | Low | Sampling from February-March 2003. |
| | Metric 6: | Spatial and Temporal Variability | Low | 50 samples were taken across 50 sampling sites. |
| | Metric 7: | Exposure Scenario | Medium | Study site zoning was not described. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data was not provided but summary statistics are detailed. |
| | Metric 9: | Quality Assurance | High | No quality control issues were identified or any identified issues were minor and adequately addressed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Occurrence of some pollutants were low but this is discussed in the limitations. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Sanchez-Avila, J., Bonet, J., Velasco, G., Lacorte, S. (2009). Determination and occurrence of phthalates, alkylphenols, bisphenol A, PBDEs, PCBs and PAHs in an industrial sewage grid discharging to a Municipal Wastewater Treatment Plant. Science of the Total Environment 407(13):4157-4167. |
| **HERO ID:** | 547906 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported |
| | Metric 3: | Biomarker Selection | N/A | the study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Maresme, Spain |
| | Metric 5: | Currency | Medium | Samples collected in 2007 |
| | Metric 6: | Spatial and Temporal Variability | High | >10 samples, replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not provided |
| | Metric 9: | Quality Assurance | Medium | Limted QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited gaps and limitations reported |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Becker, K., Guen, T., Seiwert, M., Conrad, A., Pick-Fub, H., Muller, J., Wittassek, M., Schulz, C., Kolossa-Gehring, M. (2009). Geres IV: Phthalate metabolites and bisphenol a in urine of German children. International Journal of Hygiene and Environmental Health 212(6):685-692. |
| **HERO ID:** | 551773 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Children's urine samples were taken by parents or themselves and key sampling methods and conditions were reported. Sampling methodology is clear and appropriate. |
| | Metric 2: | Analytical Methodology | High | Analytical methodologies were from published paper. Key information such as LOQs, standard measurements, instruments, extraction methods were reported. No recovery sample reported. |
| | Metric 3: | Biomarker Selection | High | Mono-benzylphthalate (MBzP) as measured metabolite. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Germany |
| | Metric 5: | Currency | Medium | Samples collected between May 2003 and May 2006. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Morning urine samples collected. >10 samples but no replicates collected. |
| | Metric 7: | Exposure Scenario | High | GerES IV used questionnaires to collect exposure information. Possible exposure scenario discussed. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not provided. Lack of variation report (SD). |
| | Metric 9: | Quality Assurance | High | Internal and external QC process applied and reported in "Methods" > "Chemical analysis" section. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited discussion about uncertainty and variability but not likely to have substantial impact on the results. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Castillo, M., Oubiña, A., Barceló, D. (1998). Evaluation of ELISA kits followed by liquid chromatography-atmospheric pressure chemical ionization-mass spectrometry for the determination of organic pollutants in industrial effluents. Environmental Science & Technology 32(14):2180-2184. |
| **HERO ID:** | 629069 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | samples described. Other article cited for sample collection details |
| | Metric 2: | Analytical Methodology | High | LOD provided, equipment described, sample prep described |
| | Metric 3: | Biomarker Selection | N/A | wastewater |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Spain |
| | Metric 5: | Currency | Low | 1996, 1997 |
| | Metric 6: | Spatial and Temporal Variability | Low | n = 5 |
| | Metric 7: | Exposure Scenario | Low | petrochemical plan effluent, landfill lechate |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | raw data in Table 2 |
| | Metric 9: | Quality Assurance | Low | Quality assurance not discussed, blanks included, no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and Uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Rockwell, D. C., Claff, R. E., Kuehl, D. W. (1984). 1981 Buffalo, New York, area sediment survey (Bass). |
| **HERO ID:** | 645755 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The sediment sampling methodology was well described. |
| | Metric 2: | Analytical Methodology | Medium | The analytical methods were described, including the LOD but not recoveries. |
| | Metric 3: | Biomarker Selection | N/A | The authors analyzed environmental samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | United States. |
| | Metric 5: | Currency | Low | Samples were collected in 1981. |
| | Metric 6: | Spatial and Temporal Variability | Low | Over 150 samples were collected from different sites along the river bank sites were rarely sampled more than once. Not all site samples were analyzed. The data reported used 77 samples from 65 sites. |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant exposure scenarios related to polluted sediments. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | The raw data is presented in the supplemental materials in table 1 (Appendix C). Summary statistics were not reported. |
| | Metric 9: | Quality Assurance | High | Methods detailed in Appendix F. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability was not characterized, nor is uncertainty discussed or characterized. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Becker, D. S., Ginn, T. C. (1995). Effects of storage time on toxicity of sediments from Puget Sound, Washington. Environmental Toxicology and Chemistry 14(5):829-835. |
| **HERO ID:** | 657922 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | sampling process and equipment described |
| | Metric 2: | Analytical Methodology | Medium | DL shown in Table 1, extraction described; EPA methods cited |
| | Metric 3: | Biomarker Selection | N/A | sediments |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | U.S. Washington |
| | Metric 5: | Currency | Low | 1989 |
| | Metric 6: | Spatial and Temporal Variability | Low | 2 sites, 1 sample per site, no replicates |
| | Metric 7: | Exposure Scenario | Low | sediments |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | raw data in Table 1 |
| | Metric 9: | Quality Assurance | Low | QA not discussed, not obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Crockett, A. B. (1997). Water and wastewater quality monitoring, McMurdo Station, Antarctica. Environmental Monitoring and Assessment 47(1):39-57. |
| **HERO ID:** | 658695 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | sampling wastewater effluent from McMurdo Station that is discharged to McMurdo Sound; also sampling ambient water and sea ice in McMurdo Sound; drilled >2 m holes to collect samples; Fig 1 provides locations of sampling stations; grab samples combined with waste brine collected from a valve at 2 to 4 week intervals collected in bottles and immediately flown to Institute of Environmental Health and Forensic Sciences in New Zealand; ambient seawater collected 1 m below ice on 3 diferent days; ice collected using peristaltic pump equipped with Teflon and silicone tubing. Some information missing such as calibration and storage. |
| | Metric 2: | Analytical Methodology | Low | determined using EPA Methods; GC/MS; detection limits not provided |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | McMurdo Station, McMurdo Sound, Antartica |
| | Metric 5: | Currency | Low | 1992-1993 |
| | Metric 6: | Spatial and Temporal Variability | High | three effluent samples, three water quality samples, and sea ice cores collected in duplicate; based on Table 1, 11 sampling periods from October 1992-Feb 1993 |
| | Metric 7: | Exposure Scenario | High | concentrations in McMurdo wastewater generated by typical domestic sources (toilets, showers, and the galley), but also includes wastewater from the maintenance shops and research laboratories; the effluent discharged to McMurdo Sound; also ambient concentrations in the Sound and it's sea ice |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 1 provides wastewater concentration per sampling date. Individual data not reported but may be found in (Crockett,1994). |
| | Metric 9: | Quality Assurance | Medium | No QA/QC section but there is some information reported- recovery of spiked extracts demonstrated analytical procedure was reasonable (p.52) |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Minimal qualitative analysis of variability and previous reports (p.48-55). No limitations reported. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Iannuzzi, T. J., Huntley, S. L., Schmidt, C. W., Finley, B. L., Mcnutt, R. P., Burton, S. J. (1997). Combined sewer overflows (CSOs) as sources of sediment contamination in the lower Passaic River, New Jersey. I. Priority pollutants and inorganic chemicals. Chemosphere 34(2):213-231. |
| **HERO ID:** | 660098 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some sampling methods not reported such as sampler calibration |
| | Metric 2: | Analytical Methodology | Medium | Some analytical methods not reported, such as recovery samples |
| | Metric 3: | Biomarker Selection | N/A | the study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | New Jersey, USA |
| | Metric 5: | Currency | Low | Samples collected in 1994 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | High | Exposure sources characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | raw data reported in the manuscript |
| | Metric 9: | Quality Assurance | Low | Limited QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Jay, K., Stieglitz, L. (1995). Identification and quantification of volatile organic components in emissions of waste incineration plants. Chemosphere 30(7):1249-1260. |
| **HERO ID:** | 660112 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | The study did not elaborate on sampling procedure. |
| | Metric 2: | Analytical Methodology | Low | Analytical and extraction method were described; however, the LOD was not provided. QC: change to low |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | German |
| | Metric 5: | Currency | Low | No sampling date is provided, but a publication date is available. |
| | Metric 6: | Spatial and Temporal Variability | Low | The study reported that measures were taken at one municipal waste incineration plant without the exact sample size. |
| | Metric 7: | Exposure Scenario | Medium | Air emission around a incineration plant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Average concentrations were reported in Table 1. |
| | Metric 9: | Quality Assurance | Low | Quality assurance techniques and results were not directly discussed, but can be implied through the study's use of standard field and laboratory protocols. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | The study has limited discussion of key uncertainties and limitations. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Otson, R., Fellin, P., Tran, Q. (1994). VOCs in representative Canadian residences. Atmospheric Environment 28(22):3563-3569. |
| **HERO ID:** | 660379 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some information described, such as equipment and storage. Additional details in (Otson et al., 1992a). |
| | Metric 2: | Analytical Methodology | Medium | Analytical methods described. LOD reported as a range not for individual chemical. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Canada |
| | Metric 5: | Currency | Low | Timing of sample collection for monitoring data is not reported, discussed, or referenced. The article was published in 1994. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 757 samples. The article mentions some replicates were done. |
| | Metric 7: | Exposure Scenario | High | Indoor air quality in residences. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | No raw data provided. Little summary statistics given. There is mention that ”An inventory of solvents used in the laboratory and analysis of OVM 3500 badges exposed in the storage refrigerator provided evidence that airborne solvents may have caused the contamination.” |
| | Metric 9: | Quality Assurance | Medium | Blanks and recoveries reported. QC was described but no section for it. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Little information provided on gaps and limitations; standard deviation nor variance reported |
| **Overall Quality Determination** | | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | Paxéus, N., Robinson, P., Balmér, P. (1992). Study of organic pollutants in municipal wastewater in G{\"o}teborg, Sweden. Water Science and Technology 25(11):249-256. |
| **HERO ID:** | 667025 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Site characteristics provided. Only one sentence is available for sampling methodology, which doesn't mention any widely accepted protocols. |
| | Metric 2: | Analytical Methodology | Low | Instrument calibration and recovery samples missing. Detection limits also missing, except for PAHs were an estimate was provided. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemicals measured in wastewater |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Goteborg, Sweden |
| | Metric 5: | Currency | Low | 1989-1991 |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicate samples and fewer than 10 samples per scenario |
| | Metric 7: | Exposure Scenario | High | Samples taken from municipal wastewater |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data points not reported |
| | Metric 9: | Quality Assurance | Low | QA/QC procedures not discussed. Can infer that some techniques were applied through citations |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No discussion of the uncertainties and limitations |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Brock, J. W., Caudill, S. P., Silva, M. J., Needham, L. L., Hilborn, E. D. (2002). Phthalate monoesters levels in the urine of young children. Bulletin of Environmental Contamination and Toxicology 68(3):309-314. |
| **HERO ID:** | 673257 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Urine samples collected but missing storage condition and collect time. |
| | Metric 2: | Analytical Methodology | Low | LOD or LOQ not provided. |
| | Metric 3: | Biomarker Selection | High | Monobenzylphthalate (MBzP) measured as metabolite. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Imperial county, CA, USA |
| | Metric 5: | Currency | Low | January to March 2000. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Urine samples collected during initial clinic visit and follow-up visit. >10 samples but no replicate collected. |
| | Metric 7: | Exposure Scenario | High | Exposure scenario reported. Exposure information collected during first clinic visit and follow-up home visit. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Individual data provided among children's urine samples. Mean, SD, and comparison to NHANES percentiles reported. |
| | Metric 9: | Quality Assurance | Medium | Creatine level reported. QC samples and methods applied. Some measurement were restricted by limited urine volume. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variation, limitation, and uncertainty due to limited urine volume of some samples were discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Hoppin, J. A., Brock, J. W., Davis, B. J., Baird, D. D. (2002). Reproducibility of urinary phthalate metabolites in first morning urine samples. Environmental Health Perspectives 110(5):515-518. |
| **HERO ID:** | 673280 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Sampling methodology reported sampling procedures, sampling equipment and sample storage conditions for first morning urine samples. Insufficient information regarding duration of sample storage prior to analysis. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Analytic methodology described in terms of extraction, analytic instrumentation, instrument calibration, limits of detection and matrix adjustment (creatinine) method. Insufficient information regarding recoveries. |
| | Metric 3: | Biomarker Selection | High | High. Metabolite of parent. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Samples provided by study participants residing in Washington, D.C. |
| | Metric 5: | Currency | Low | Low. Sampling conducted 1996-1997. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Medium. Two consecutive first-morning urines collected from each of 46 African American participants. Participants randomly selected as representative sample of low to high income strata of study population. Authors acknowledged lack of data regarding temporal variability. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Exposure sources for study participants not discussed. Population demographics described in terms of race, age and range of income (low to high income strata). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Summary statistics for urinary metabolite concentration results presented in terms of description of data (location, population, year of sampling), concentration range, number of samples, frequency of detection, measure of variation (standard deviation), and measure of central tendency (mean, median). Outliers were not removed from data set to obtain measures of variability. Insufficient information regarding raw data. |
| | Metric 9: | Quality Assurance | Medium | Medium. Quality assurance parameters described in terms of method blanks, batch-specific quality assurance samples from pooled first morning void samples of women of similar ages, and creatinine levels. Samples described as not meeting lab quality assurance criteria excluded (mEP measures on 11 subjects and mINP in one sample). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Medium. Between- and within-subject variability indicated through intra-class correlation coefficients. Between-subject variability noted as greater than within-subject variability. Summary variability statistics reported. Authors discussed limitations of lack of data regarding temporal variability. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Berman, T., Hochner-Celnikier, D., Calafat, A. M., Needham, L. L., Amitai, Y., Wormser, U., Richter, E. (2009). Phthalate exposure among pregnant women in Jerusalem, Israel: results of a pilot study. Environment International 35(2):353-357. |
| **HERO ID:** | 673439 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology details reported for sampling procedure, sample storage conditions and duration of sample storage prior to analyses. Insufficient information regarding sampling equipment |
| | Metric 2: | Analytical Methodology | Medium | Analytic methodology details reported for extraction method, analytical instrumentation, chemical-specific limits of detection and matrix-adjustment method for urine sample analyses. Insufficient information regarding instrument calibration. |
| | Metric 3: | Biomarker Selection | Low | BBP—MBP is a metabolite of BBP and also DBP. Sampled for BBzP too. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Urine samples collected from participants in Jerusalem. |
| | Metric 5: | Currency | Medium | Urine samples collected at recruitment in 2006. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Single spot urine specimens collected from pregnant women (n=19) in Jerusalem hospital settings across different areas of city. |
| | Metric 7: | Exposure Scenario | Medium | Authors noted participants came from diverse ethnic and socioeconomic backgrounds, with results reported stratified across age of residential building as well as for use of personal care products. Occupational data obtained from extensive questionnaire. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Statistical summary measures of urinary metabolite total number of samples, geometric mean, median, and concentration ranges reported. Description of data in terms of year of sampling, location and population characteristics summarized. Insufficient information regarding raw data and consideration for tests for outliers. |
| | Metric 9: | Quality Assurance | Medium | Quality assurance details reported for sample analytics, reagent blanks and protocols. Results adjusted for creatinine. Lack of pre-exposure sampling and reporting of recovery data. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Statistical summary measures lacked standard deviations but reported ranges, limitations of sample size and spot urine specimens discussed. |
| **Overall Quality Determination** | | | **Medium** | |

**Study Citation:** Bornehag, C. G., Sundell, J., Weschler, C. J., Sigsgaard, T., Lundgren, B., Hasselgren, M., Hägerhed-Engman, L. (2004). The association between asthma and allergic symptoms in children and phthalates in house dust: A nested case-control study. Environmental Health Perspectives 112(14):1393-1397.

**HERO ID:** 673441

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Most key criteria met; lack of sample storage conditions/duration information. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Most key criteria described, detection limits reported. |
| | Metric 3: | Biomarker Selection | N/A | N/A. Sampling for parent chemical in environmental media (dust). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Samples provided by participants in Varmland, Sweden. |
| | Metric 5: | Currency | Low | Low. Sample collection dates noted as October, 2001 through April, 2002. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Medium. Single dust concentration sampling results from 346 homes with dust sampled from molding and shelves of participating child's bedroom, with sampling conducted within single season of 2001-2002. Non-statistical sampling methods. |
| | Metric 7: | Exposure Scenario | Low | Low. Dust concentrations measured within participating child's bedroom with samples obtained from molding and shelves of bedroom with additional microenvironment data not provided. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Most key criteria met; lack of raw data and variation measure (other than 95% confidence interval across case-control status. |
| | Metric 9: | Quality Assurance | Medium | Medium. Some key criteria met; lack of baseline pre-exposure sampling, DBH study methods referenced. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Medium. Variability characterized within summary statistics (95% confidence interval), potential study limitations and biases discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Chou, Y. Y., Huang, P. C., Lee, C. C., Wu, M. H., Lin, S. J. (2009). Phthalate exposure in girls during early puberty. Journal of Pediatric Endocrinology & Metabolism 22(1):69-77. |
| **HERO ID:** | 673445 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Sampling methodology described in terms of sampling equipment, procedures, and sample storage conditions. Insufficient information regarding duration of sample storage prior to analysis, study site characteristics. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Analytic methodology described in terms of extraction, analytical instrumentation, limits of detection, recoveries. Insufficient information on consideration of matrix adjustment method (creatinine). |
| | Metric 3: | Biomarker Selection | High | High. Metabolites specific to parent chemicals of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Urine samples provided by study participants residing in Taiwan. |
| | Metric 5: | Currency | Low | Low. Dates of sampling not detailed; study publication date 2009. |
| | Metric 6: | Spatial and Temporal Variability | Low | Low. Urine samples described as collected in the morning (not necessarily first morning samples) for n=89 girls. No replicate samples. Single samples that do not represent all periods of time or representative locations. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Exposure scenario described in terms of structured questionnaire responses regarding food and consumer product frequency of use results correlated with exposure concentration results. Description of microenvironment (climate, time) not detailed. Lack of exposure controls. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Description of population in terms of demographics (age, weight, height), measure of central tendency (mean) and variation (standard deviation) and number of samples. Insufficient information regarding range of concentrations, raw data and frequency of detection. |
| | Metric 9: | Quality Assurance | Medium | Medium. Study documented quality assurance measures of batch-specific blank and quality samples, recoveries. Insufficient information regarding baseline (pre-exposure) sampling. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Low. Standard deviations reported for mean concentrations. Lack of discussion of study limitations. |

## Overall Quality Determination — Medium

**Study Citation:** Hogberg, J., Hanberg, A., Berglund, M., Skerfving, S., Remberger, M., Calafat, A. M., Filipsson, A. F., Jansson, B., Johansson, N., Appelgren, M., Hakansson, H. (2008). Phthalate diesters and their metabolites in human breast milk, blood or serum, and urine as biomarkers of exposure in vulnerable populations. Environmental Health Perspectives 116(3):334-339.

**HERO ID:** 673465

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sample selection (women invited to participate) based on 130 consecutive normal births in one hospital, not stratified to represent general population characteristics of Sweden overall. |
| | Metric 2: | Analytical Methodology | High | GC-MS; sample prep and extraction described in detail by matrix |
| | Metric 3: | Biomarker Selection | High | Measured parent phthalates and their metabolites in breast milk, blood (or plasma), and urine. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sweden |
| | Metric 5: | Currency | Low | Samples collected in 2001 |
| | Metric 6: | Spatial and Temporal Variability | High | Cohort of Swedish women that delivered at Lund University Hospital, 130 consecutive deliveries invited to participate; final n = 42. Time span (dates) unspecified; single hospital. |
| | Metric 7: | Exposure Scenario | Medium | General population of pregnant Swedish women after delivery in hospital; all interviewed about lifestyle habits, use of hygiene and other products, and other relevant information. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Reported mean, SD, n, min, max, median, 75th percentile, and LOD by chemical and matrix. Raw data not provided. |
| | Metric 9: | Quality Assurance | High | At Swedish institutes, calibration and recoveries from standard mixture of 6 phthalate esters; reported concentrations corrected for recovery. Precision, uncertainty, and recovery rates reported; high and low quality assurance spiked samples; reagent blanks included. Several techniques used to minimize contamination from sample collection through analysis. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Discussed results and correlations (or lack thereof) in conjunction with factors that might account for them. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Hong, Y. C., Park, E. Y., Park, M. S., Ko, J. A., Oh, S. Y., Kim, H., Lee, K. H., Leem, J. H., Ha, E. H. (2009). Community level exposure to chemicals and oxidative stress in adult population. Toxicology Letters 184(2):139-144. |
| **HERO ID:** | 673466 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Sampling methodology details of sampling procedures and sample storage conditions briefly described. Insufficient information regarding sampling equipment. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Analytic methodology details of extraction method, limits of detection, analytical instrumentation described. Insufficient information regarding instrument calibration and recovery samples. |
| | Metric 3: | Biomarker Selection | High | High: BPA, MEHHP, MEOHP metabolites of parent chemicals only |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Samples provided by participants in Korea. |
| | Metric 5: | Currency | Medium | Medium. Samples collected in 2005 |
| | Metric 6: | Spatial and Temporal Variability | Low | Low. A total of 513 urine samples were collected. Single morning sample collected from each participant, no replicate samples. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Participant demographics, lifestyle habits, medical and employment history and environmental exposure details collected from a structured questionnaire. Potential sources of exposure through consumer products briefly discussed. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Summary statistic data described population and month, year of sampling, percentile concentrations, number of samples, frequency of detection, measure of variation (SD), and measure of central tendency (mean, median). Insufficient information regarding raw data from each participant. |
| | Metric 9: | Quality Assurance | Low | Low. Quality assurance and control parameters not directly discussed but can be inferred from study's use of standard laboratory protocols. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Medium. Summary statistic measures of variation (SD) for participant urinary chemical concentrations. Report includes discussion of limitations, which include temporality uncertainties due to cross-sectional nature of study as well as single urine sample for characterization of chemical concentrations with known relatively short half-lives. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Huang, P. C., Kuo, P. L., Chou, Y. Y., Lin, S. J., Lee, C. C. (2009). Association between prenatal exposure to phthalates and the health of newborns. Environment International 35(1):14-20. |
| **HERO ID:** | 673468 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Sampling methodology described for urine and amniotic fluid samples in terms of sampling equipment, procedures, sample storage conditions and study site characteristics. Insufficient information regarding duration of sample storage prior to analyses. |
| | Metric 2: | Analytical Methodology | High | High. Analytic methodologies described in terms of extraction, analytical instrumentation, limits of detection, recoveries and matrix adjustment (creatinine for urine). |
| | Metric 3: | Biomarker Selection | Low | Low: (MBP metabolite of DBP and/or BBP). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Sampling conducted on participants in Taiwan. |
| | Metric 5: | Currency | Medium | Medium. Samples collected from participants in 2005-2006. |
| | Metric 6: | Spatial and Temporal Variability | Low | Low. 64 amniotic fluid samples and 64 urine specimens obtained from 64 participants. Single specimens collected from each participant, including spot urine samples at time of amniocentesis medical appointment. No replicate samples. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Sources of exposure described within text briefly. Lack of data regarding employment status. Demographic characteristics of participant mothers providing samples not described. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Summary statistics of urinary and amniotic fluid concentrations reported as number of samples, minimum, maximum, 10th, median and 90th percentile concentrations and frequency of detection. Insufficient information regarding consideration for outliers in analysis of birth outcomes. |
| | Metric 9: | Quality Assurance | Medium | Medium. Quality assurance and control parameters described in terms of laboratory blanks and quality control samples, laboratory recoveries and creatinine for urinary specimens. Authors noted failure of one amniotic fluid sample during analysis. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | High. Robust discussion of study limitations noted in referenced study (Huang et al., 2007; HERO ID 673469). Sample concentration standard deviation or standard error measures lacking, however authors reported concentration ranges. |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | Koch, H. M., Rossbach, B., Drexler, H., Angerer, J. (2003). Internal exposure of the general population to DEHP and other phthalates–determination of secondary and primary phthalate monoester metabolites in urine. Environmental Research 93(2):177-185. |
| **HERO ID:** | 673472 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some methods not reported such as sample storage conditions |
| | Metric 2: | Analytical Methodology | Medium | recovery samples not reported. Precise LOQ not reported for all metabolites. |
| | Metric 3: | Biomarker Selection | Low | MnBuP is a metabolite of both DBP and BBP parent chemicals. MBzP was another metabolite measured. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Germany |
| | Metric 5: | Currency | Low | Samples collected before 2004 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | High | Exposure to phthalates among the general population was characterized. Authors provided some examples of exposure sources (e.g., foodstuff, cosmetics, air) to the general population. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported |
| | Metric 9: | Quality Assurance | Medium | Missing some QA measures like recoveries |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | SDs, 95th percentiles, and min/max values provided to characterize variance. Gaps and limitations included in discussion section. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Kolarik, B., Naydenov, K., Larsson, M., Bornehag, C. G., Sundell, J. (2008). The association between phthalates in dust and allergic diseases among Bulgarian children. Environmental Health Perspectives 116(1):98-103. |
| **HERO ID:** | 673473 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | A 1,600-W vacuum cleaner equipped with a phthalate-free ALK dust sampling device was used for the dust collection. The dust samples were wrapped in aluminum foil and kept in a polyethylene bag with a zip lock, so that the dust had no contact with the bag. Samples were frozen the day of sampling at –18°C. |
| | Metric 2: | Analytical Methodology | High | LOD reported, the analytical methodology is described |
| | Metric 3: | Biomarker Selection | High | Urine BBzP |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Bulgaria |
| | Metric 5: | Currency | Medium | 2004-2005 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 177 homes of Bulgarian children, no sample replicates |
| | Metric 7: | Exposure Scenario | High | biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data. Table 2. The concentrations of phthalates (mg phthalate per g dust) measured in 177 homes of Bulgarianchildren shown as geometric mean with 95% CIs. |
| | Metric 9: | Quality Assurance | Critically Deficient | QA not reported in any of the cohort studies. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Key limitations no reported. Variability presented as 95% CI |

## Overall Quality Determination — Uninformative

| | |
|---|---|
| **Study Citation:** | Lomenick, J. P., Calafat, A. M., Melguizo Castro, M. S., Mier, R., Stenger, P., Foster, M. B., Wintergerst, K. A. (2010). Phthalate exposure and precocious puberty in females. Journal of Pediatrics 156(2):221-225. |
| **HERO ID:** | 673478 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Sampling methodology described in terms of urine sampling equipment container materials, sample storage conditions prior to analysis, study site (pediatric endocrinology clinic). Insufficient information regarding duration of sample storage prior to analysis. |
| | Metric 2: | Analytical Methodology | Low | Low. Analytic methodology described in main text in terms of extraction, analytical instrumentation, use of instrument calibration standards, and matrix-adjustment method (creatinine). Investigators reported limits of detection as a range within "low nanogram per milliliter range" but did not specify numeric range. Samples specified as analyzed at the Centers for Disease Control and Prevention (CDC). Insufficient information regarding sample recoveries and numeric specification of limits of detection. |
| | Metric 3: | Biomarker Selection | Low | MBzP metabolite of BBP parent phthalate; MBP metabolite of both DBP and BBP parent. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Samples provided by participants recruited from the University of Kentucky College of Medicine Department of Pediatric Endocrinology. |
| | Metric 5: | Currency | Medium | Medium. Recruitment specified as between 2005-2008. |
| | Metric 6: | Spatial and Temporal Variability | Low | Low. Single, spot urine samples collected from 28 central precocious puberty (CPP) cases and 28 control children. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Participant demographic and baseline weight, height and BMI characteristics summarized within Table 1. Authors noted urinary phthalate metabolite concentrations similar to children of similar ages within NHANES 2001-2002. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Urinary phthalate metabolite concentrations reported with summary statistics of mean and standard error in CPP case and control children with years of recruitment, number of samples and location of clinic collecting sample specified. Insufficient information regarding phthalate metabolite concentration range or percentiles, frequency of detection, tests for outliers and raw data. |
| | Metric 9: | Quality Assurance | Medium | Medium. Quality assurance procedures of internal standards utilized to increase precision, calibration standards used within each analytical run, reagent blanks and quality control materials of high and low concentration to monitor for accuracy and precision. CDC analysts blinded to participant characteristics. Phthalate metabolite concentrations corrected for creatinine. Insufficient information regarding field, laboratory or storage recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Medium. Statistical variability summarized within phthalate metabolite concentration summary statistic of standard deviation. Investigators presented a relatively robust discussion of study limitations and reasoning for results. Authors detailed uncertainty in importance of timing of phthalate sampling in adequately representing the intensity, duration and potential peak exposures responsible for initiation and development of CPP case status. |

## Overall Quality Determination Medium

**Study Citation:** Main, K. M., Mortensen, G. K., Kaleva, M. M., Boisen, K. A., Damgaard, I. N., Chellakooty, M., Schmidt, I. M., Suomi, A. M., Virtanen, H. E., Petersen, J. H., Andersson, A. M., Toppari, J., Skakkebaek, N. E. (2006). Human breast milk contamination with phthalates and alterations of endogenous reproductive hormones in infants three months of age. Environmental Health Perspectives 114(2):270-276.

**HERO ID:** 673480

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Phthalate breast milk sampling methodology described in terms of sampling equipment, procedures, sample storage conditions. Insufficient information regarding duration of sample storage time prior to analysis |
| | Metric 2: | Analytical Methodology | High | Phthalate analytic methodology described in terms of extraction method, analytical instrumentation, and recoveries of 93-104%. Chemical-specific limits of detection reported in Table 2 along with detection rates. Insufficient information regarding instrument calibration, however additional details referenced [Mortensen et al., 2005]. |
| | Metric 3: | Biomarker Selection | Low | BBP—MBP is a metabolite of DBP and BBP parent chemicals; and High BBP—MBzP is a metabolite specific to BBP parent |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Breast milk samples collected from women in Denmark and Finland. |
| | Metric 5: | Currency | Low | Breast milk sample data results from samples collected 1997-2001. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Single breast milk sample pooled from each participant's collection of multiple breast milk samples collected over successive infant feedings over several weeks up to a maximum sample volume of 200 mL. Insufficient information with regards to sample-specific weeks of sampling time, however breast milk samples collected between one and three months after birth. Breast milk samples provided by women in Denmark (n=64) and Finland (n=65). |
| | Metric 7: | Exposure Scenario | Medium | Study population demographic characteristics reported in Table 1 for maternal and child characteristics. Potential non-occupational exposure sources discussed briefly in text introduction. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics of breast milk phthalate concentrations reported median, range, frequency of detection and number of samples for reported concentrations within Table 2. Insufficient information regarding tests for outliers and timing or dates of sample collection, as well as raw data. |
| | Metric 9: | Quality Assurance | Medium | Quality assurance details of laboratory recoveries and coefficients of variation range. Analyses noted as conducted by personnel blinded with regard to the child's clinical examination or other outcome measures. Authors noted information on 57 of Danish mothers was noted regarding breast pump usage, rather than manual expression into provided glass jars, with 26 (46%) noting use of a pump on one or more occasions during sample collection. However study focused upon phthalate metabolites, which would not have originated from breast pump sample collection containers and equipment. Only breast milk samples with >50 mL volumes were included, however number of samples with insufficient volume not detailed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Statistical summary variability measure of concentration ranges reported. Authors discussed limitations, including knowledge that child phthalate exposure may not be adequately represented by maternal breast milk concentrations, which is only one of many potential exposure routes. Authors acknowledged and discussed lack of information on individual sources of exposure as well as potential sample contamination through breast pump use. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Meeker, J. D., Hu, H., Cantonwine, D. E., Lamadrid-Figueroa, H., Calafat, A. M., Ettinger, A. S., Hernandez-Avila, M., Loch-Caruso, R., Tellez-Rojo, M. M. (2009). Urinary phthalate metabolites in relation to preterm birth in Mexico city. Environmental Health Perspectives 117(10):1587-1592. |
| **HERO ID:** | 673483 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology only briefly discussed in terms of spot urine, second morning void, sampling. Insufficient information not likely to impact results includes details on sampling equipment, sample storage conditions, and duration of sample storage. |
| | Metric 2: | Analytical Methodology | Medium | Analytic methodology described and referenced (Silva et al., 2007) in terms of extraction, analytical instrumentation, limit of detection (LOD) range, and matrix adjustment (creatinine and specific gravity). Insufficient information regarding recoveries. |
| | Metric 3: | Biomarker Selection | Low | Measured MBP (metabolite of DBP or BBP) and MCPP (metabolite of DBP or DOP). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples provided by participants in Mexico City prenatal clinics. |
| | Metric 5: | Currency | Low | Recruitment during pregnancy 2001-2003. |
| | Metric 6: | Spatial and Temporal Variability | Low | A total of n=30 preterm birth cases and n=30 normal gestational birth controls, however single spot, second morning urine samples collected from participants. |
| | Metric 7: | Exposure Scenario | Medium | Participant demographic data collected and reported. Potential sources of exposure briefly discussed. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Statistical summary measures of number of samples, concentration percentiles, maximum concentration, measures of central tendency of geometric mean and median concentrations and frequency of detection reported. Insufficient information regarding tests for outliers and raw data. |
| | Metric 9: | Quality Assurance | Medium | Authors reported quality assurance and control parameters of use of calibration standards, reagent blanks and quality control materials in analytic procedures quantifying chemicals of interest. Authors noted urine samples of women delivering at term were more dilute than those of women delivering preterm, as well as other potential study limitations. Authors noted high percentage (33%) of samples <LOD for MCOP and MCNP. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Authors reported statistical summary measures of variation, uncertainties were minimal, and authors discussed study limitations. |
| **Overall Quality Determination** | | | **Medium** | |

**Study Citation:** Adibi, J. J., Whyatt, R. M., Williams, P. L., Calafat, A. M., Camann, D., Herrick, R., Nelson, H., Bhat, H. K., Perera, F. P., Silva, M. J., Hauser, R. (2008). Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples. Environmental Health Perspectives 116(4):467-473.

**HERO ID:** 673513

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling equipment, procedures, storage conditions and duration, calibration of sampler and study site characteristics depicted |
| | Metric 2: | Analytical Methodology | Low | The study analyzed sample using LC-MS. LOD calculation was provided but the numbers were not provided. |
| | Metric 3: | Biomarker Selection | High | Biomarker (parent chemical or metabolite) is derived from exposure to the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | 3 New York City neighborhoods |
| | Metric 5: | Currency | Low | The study did not provide a date of sampling, but publication date is available - 2008. |
| | Metric 6: | Spatial and Temporal Variability | High | 96 personal air samples, 16 mother urine samples, 19 newborn urine samples. |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant exposure scenario (population/scenario/media of interest). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Mean concentrations were reported with the standard errors. |
| | Metric 9: | Quality Assurance | Low | Quality assurance/quality control techniques and results were not directly discussed, but can be implied through the study's use of standard field and laboratory protocols. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Authors compared results to published data. Methods to analyze urine variability was provided. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Blount, B. C., Silva, M. J., Caudill, S. P., Needham, L. L., Pirkle, J. L., Sampson, E. J., Lucier, G. W., Jackson, R. J., Brock, J. W. (2000). Levels of seven urinary phthalate metabolites in a human reference population. Environmental Health Perspectives 108(10):979-982. |
| **HERO ID:** | 673515 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | High. Urine samples originally collected as part of the United States Third National Health and Nutrition Examination Survey (NHANES III) 1988-1994. Non-fasting urines collected. NHANES is a series of nationally representative cross-sectional surveys on the health and nutrition of civilian, noninstitutionalized adults and children conducted by the Centers for Disease Control and Prevention (CDC). Sampling methodology not directly discussed in terms of sampling equipment, procedures, storage conditions/duration, calibration of sampler or study site characteristics, however NHANES sampling methodology with established high level of accepted methodologies. |
| | Metric 2: | Analytical Methodology | High | High. Analytic methodology utilized NHANES III publicly available and established methodologies. Extraction method, analytical instrumentation, limits of detection and matrix adjustment method (creatinine) reported. |
| | Metric 3: | Biomarker Selection | High | High: MBzP, MEHP, MNP metabolites of parent BBP, DEHP, and DNP, respectively. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Location of participants providing samples not reported, however data obtained through NHANES III, with publicly available methodologies for the 1988-1994 survey cycle. |
| | Metric 5: | Currency | Low | Low. Samples provided by NHANES participants 1988-1994. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Medium. Urine sample data obtained from random sample of participants within NHANES III with established methodologies. Random sampling noted by authors to not be a representative sample of the US population but rather representative of the demographically described groups. Single urine sample analyzed from each of 289 participants. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Potential consumer product sources of exposure briefly discussed. Insufficient information regarding occupational status of participants. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Summary statistics details of population and years of sampling, concentration range (min, max), frequency of detection, measure of central tendency (geometric mean, median), concentration percentiles reported. Insufficient information regarding raw data for each participant, tests for outliers, number of samples for each reported chemical-specific summary concentration and additional measures of variation (SD). |
| | Metric 9: | Quality Assurance | High | High. Quality assurance and control parameters of method blanks and quality control lab samples reported. NHANES methodologies with established quality control parameters. Additional methodologies to prevent sample contamination through equipment components without PVC plastics noted. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Medium. Insufficient information regarding standard summary statistic measure of variation (SD, SE), however range of concentrations provided. Brief discussion of limited study sample size and non-representative nature of random sampling. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Latini, G., Wittassek, M., Del Vecchio, A., Presta, G., De Felice, C., Angerer, J. (2009). Lactational exposure to phthalates in Southern Italy. Environment International 35(2):236-239. |
| **HERO ID:** | 673525 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology described in terms of sampling equipment, procedures, sample storage conditions and study site characteristics for in-hospital collection of breast milk samples. Insufficient information regarding duration of sample storage prior to analysis of breast milk samples. |
| | Metric 2: | Analytical Methodology | High | Analytical methodology described in terms of extraction, analytical instrumentation, instrument calibration, chemical-specific limits of detection, recoveries and matrix adjustment (milk fat removal). LOQ/LOD provided in written form under ”2.2 Chemical analysis.” |
| | Metric 3: | Biomarker Selection | High | Sampling for breast milk phthalate metabolites specific for parent chemicals. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Breast milk samples provided by participants in Brindisi and Tricase areas of Southern Italy. |
| | Metric 5: | Currency | Medium | Medium. Participant samples described as collected during March and September 2006. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Single breast milk samples described as collected from random selection of 62 healthy mothers. Sampling conducted during one month of Spring and Fall seasons in 2006. |
| | Metric 7: | Exposure Scenario | Medium | Participant characteristics of age reported. Potential phthalate sources discussed generally in introduction |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Median, 95% confidence interval, maximum, and 95th percentile summary measures of phthalate concentrations reported along with number of samples and a description of data sampling location (hospital) and sampling month/year. Insufficient information regarding raw data. |
| | Metric 9: | Quality Assurance | High | Quality assurance parameters and quality control procedures reported. Internal laboratory quality control samples conducted for each analytic series. Laboratory recoveries reported. Procedures for sample collection noted avoiding use of latex gloves and/or breast pumps with participant assistance in hospital by a nurse, cleaning of breast prior to sampling and noted avoidance of use of cleansers or ointments. Sample collection noted use of glass and polypropylene devices with authentic rubber seals and stoppers. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Statistical summary measures of variability reported. Authors noted comparability of findings with previous studies, and discussed the lack of elimination of potential esterase activity in the milk resulting in potential contamination by phthalate diesters and subsequent hydrolysis to the monoesters during collection. However, this enzyme activity was assumed to be minimal due to -25˚C storage and immediate treatment with phosphoric acid to eliminate all hydrolase activity. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Sathyanarayana, S., Calafat, A. M., Liu, F., Swan, S. H. (2008). Maternal and infant urinary phthalate metabolite concentrations: Are they related?. Environmental Research 108(3):413-418. |
| **HERO ID:** | 673527 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Sampling methodology described in terms of sampling equipment for infant samples, procedures, study site (clinic), and sample storage conditions. Insufficient information regarding duration of maternal and infant urine sample storage prior to analysis. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Analytical methodology described in terms of extraction analytical instrumentation, instrument calibration, chemical-specific limits of detection and creatinine-adjustment. Insufficient information regarding sample recoveries. LODs provided as a range for all metabolites. |
| | Metric 3: | Biomarker Selection | Low | Low. Sampling for metabolites not specific to one parent chemical. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Urine samples provided by participants from California, Missouri, Iowa, and Minnesota. |
| | Metric 5: | Currency | Low | Low. Dates of urine specimen collection from SFFII study not specified. Publication date 2008. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Medium. Urine specimens provided by n=210 maternal-infant pairs. Participants resided in four different states. Single spot urine specimens provided by both mothers and infants. Insufficient information regarding timing of sample (first morning) for mothers. Non-statistical sampling approach with participants from original SFFI study that were eligible to participate within SFFII. No replicates |
| | Metric 7: | Exposure Scenario | High | Medium. Demographic characteristics of mothers and infants provided in Table 1. Potential sources of exposure discussed in introduction and discussion. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Statistical summary measures of number of samples and geometric mean phthalate concentrations along with location (state) of sampling and frequency of detection presented for mothers and infants. Results presented as creatinine adjusted and unadjusted concentrations. Insufficient information regarding dates of sampling, range of concentrations or percentiles, measure of variation, tests for outliers within regression analyses and raw data. |
| | Metric 9: | Quality Assurance | Medium | Medium. Quality assurance discussed in terms of sampling equipment prescreening for monoester phthalate metabolites, laboratory quality control and reagent blank samples. Insufficient information regarding recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Low. Statistical variability measures for reported concentrations (standard deviations) lacking. Some study limitations regarding creatinine, lack of home environmental or dietary phthalate measures discussed. |

## Overall Quality Determination — Medium

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|---|---|
| **Study Citation:** | Silva, M. J., Reidy, J. A., Herbert, A. R., Preau, J. L., Jr, Needham, L. L., Calafat, A. M. (2004). Detection of phthalate metabolites in human amniotic fluid. Bulletin of Environmental Contamination and Toxicology 72(6):1226-1231. |
| **HERO ID:** | 673529 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Low. Sampling methodology only briefly discussed for amniotic fluid samples reported as taken during routine amniocentesis and utilizing only residual specimens for analysis. Insufficient information regarding sampling equipment, sample storage conditions and duration. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Analytic methodology described in terms of extraction, analytical instrumentation, calibration, chemical-specific limit of detection (LOD). Insufficient information regarding recoveries. |
| | Metric 3: | Biomarker Selection | Low | Low. Measured metabolites not specific for parent chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | Critically Deficient | Unacceptable. Geographic location of participants providing samples not reported, discussed, or referenced. |
| | Metric 5: | Currency | Low | Low. Dates of sample collection not reported. Publication date 2004. |
| | Metric 6: | Spatial and Temporal Variability | Low | Low. A total of 54 anonymous donors provided amniotic fluid samples for the current study. Insufficient information regarding location and dates of sample collection. |
| | Metric 7: | Exposure Scenario | Low | Low. Participant demographic information unavailable to researchers and not reported. Potential sources of exposure discussed |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Statistical summary measures of number of samples, minimum and maximum concentrations, median and percentiles (10th, 25th, 75th, 90th and 95th). Insufficient information regarding description of data in terms of location, dates of sampling and raw data. |
| | Metric 9: | Quality Assurance | Medium | Medium. Quality control details of quality control materials prepared from spiked human urine, reagent blanks and standards reported. Insufficient information regarding recoveries and authors noted potential for DEHP contamination of samples during collection and storage followed by production of mEHP metabolites by lipase enzyme activity in the amniotic fluid or by hydrolysis during sample work-up. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Low. Statistical summary measures of variability reported. Uncertainty with regards to potential DEHP contamination of collection and storage materials. Discussion of limitations limited to acknowledgement of potential for DEHP contamination. |

## Overall Quality Determination — Uninformative

| | |
|---|---|
| **Study Citation:** | Ye, X., Pierik, F. H., Hauser, R., Duty, S., Angerer, J., Park, M. M., Burdorf, A., Hofman, A., Jaddoe, V. W., Mackenbach, J. P., Steegers, E. A., Tiemeier, H., Longnecker, M. P. (2008). Urinary metabolite concentrations of organophosphorous pesticides, bisphenol A, and phthalates among pregnant women in Rotterdam, the Netherlands: The Generation R study. Environmental Research 108(2):260-267. |
| **HERO ID:** | 673535 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sample collection followed the methodology from the Generation R cohort study |
| | Metric 2: | Analytical Methodology | High | The analytical method is described and the LOD reported. |
| | Metric 3: | Biomarker Selection | High | Urine MBzP |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Netherlands |
| | Metric 5: | Currency | Low | 2004 |
| | Metric 6: | Spatial and Temporal Variability | Medium | No sample replicates. Urinary phthalate metabolites of 100 women |
| | Metric 7: | Exposure Scenario | High | Exposure to phthalate metabolites in pregnant women from Netherlands |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No individual data points reported. Table 3 reports creatinine adjusted metabolites: GM, GSD, Min, Max and percentiles |
| | Metric 9: | Quality Assurance | High | QA/QC included the analysis of control samples and interlaboratory calibrations |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Key limitations reported. Variability of population reported in table 3 |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Adibi, J. J., Perera, F. P., Jedrychowski, W., Camann, D. E., Barr, D., Jacek, R., Whyatt, R. M. (2003). Prenatal exposures to phthalates among women in New York City and Krakow, Poland. Environmental Health Perspectives 111(14):1719-1722. |
| **HERO ID:** | 674904 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Study provided sampling methodology, procedure, sample storage, and matric characters. |
| | Metric 2: | Analytical Methodology | Low | LOD was mentioned to be calculated but not reported. |
| | Metric 3: | Biomarker Selection | High | Biomarker (parent chemical or metabolite) is derived from exposure to the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | New York City |
| | Metric 5: | Currency | Low | Sampling date is provided (March-July 2000). |
| | Metric 6: | Spatial and Temporal Variability | Medium | Personal air samples (n=30) and urinary concentrations (n=25) |
| | Metric 7: | Exposure Scenario | High | The data likely represent the relevant exposure scenario (population/scenario/media of interest). Source of exposure was not provided. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Mean concentrations were provided with standard deviation, but individual data points were not provided. |
| | Metric 9: | Quality Assurance | Medium | Quality assurance/quality control techniques and results were not directly discussed, but can be implied through the study's use of standard field and laboratory protocols. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Key uncertainties, limitations, and data gaps have been identified. |
| **Overall Quality Determination** | | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | Bornehag, C. G., Lundgren, B., Weschler, C. J., Sigsgaard, T., Hagerhed-Engman, L., Sundell, J. (2005). Phthalates in indoor dust and their association with building characteristics. Environmental Health Perspectives 113(10):1399-1404. |
| **HERO ID:** | 674952 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | High. Key criteria met, sample storage duration noted as 2-3 days. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Most key criteria described, detection limits reported but not for each chemical, analytic methods referenced. |
| | Metric 3: | Biomarker Selection | N/A | N/A. Sampling for parent chemical in environmental media (dust). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Samples provided by participants in Varmland, Sweden. |
| | Metric 5: | Currency | Low | Low. Sample collection dates noted as October, 2001 through April, 2002. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Medium. Single dust concentration sampling results from 346 homes with dust sampled from molding and shelves of participating child's bedroom, with sampling conducted within single season of 2001-2002. Non-statistical sampling methods. Unclear if there are replicates. |
| | Metric 7: | Exposure Scenario | Medium | Low. Dust concentrations measured within participating child's bedroom with samples obtained from molding and shelves of bedroom with additional microenvironment data not provided. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Most key criteria met; lack of raw data. |
| | Metric 9: | Quality Assurance | Low | Medium. QA not directly stated. Some key criteria met; lack of baseline pre-exposure sampling, DBH study methods referenced. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Medium. Variability characterized within summary statistics (95% confidence interval), variation in surface and wall material, potential study limitations and biases discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Cousins, A. P., Remberger, M., Kaj, L., Ekheden, Y., Dusan, B., Brorstroem-Lunden, E. (2007). Results from the Swedish National Screening Programme 2006. Subreport 1: Phthalates. GRA and I(GRA and I):39. |
| **HERO ID:** | 675060 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Samples of air (no other media) collected both from background and phthalate source areas; quantity of air collected per sample not specified (flow rate 1 m3/hr, duration NS). |
| | Metric 2: | Analytical Methodology | Low | Data on target ion and qualifier ion in MS not provided. |
| | Metric 3: | Biomarker Selection | N/A | BBP metabolites not analyzed. Only analyzed MEHP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sweden. |
| | Metric 5: | Currency | Medium | 2006 |
| | Metric 6: | Spatial and Temporal Variability | Low | Twelve air sample locations: 3 background, 3 urban, 3 near Gislaved point source, and 3 near Stenungsund point source. |
| | Metric 7: | Exposure Scenario | High | Ambient air. Relevant to human inhalation exposure. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Concentrations reported graphically or by range and detection frequency depending on the medium. |
| | Metric 9: | Quality Assurance | Low | Precautions taken against contamination of equipment; no other discussion of quality assurance; chromatogram spread with mixture of isomers introduced noise. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and uncertainty not discussed; reader make some inferences from bar graphs. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Huang, P. C., Tien, C. J., Sun, Y. M., Hsieh, C. Y., Lee, C. C. (2008). Occurrence of phthalates in sediment and biota: Relationship to aquatic factors and the biota-sediment accumulation factor. Chemosphere 73(4):539-544. |
| **HERO ID:** | 675207 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | For each of 17 rivers, collected sediments from 3 or 4 locations at midstream or downstream of existing water quality monitoring network stations; fish either caught or bought from local fisherman; small fish of same species pooled together. Location (i.e., named river) of individual fish sampled not reported. |
| | Metric 2: | Analytical Methodology | High | Sediment samples analyzed per US EPA SW-846 Method 8270, modified. GC/MS. Same technique apparently used to analyze fish muscle tissues. LODs reported. |
| | Metric 3: | Biomarker Selection | N/A | N/A is more appropriate. While authors did normalize fish muscle concentration to lipids and sediment concentrations to total organic carbon content, they did not measure any metabolites per se. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Taiwan rivers. |
| | Metric 5: | Currency | Medium | 2004 and 2005: dry (March-April) and wet (August-October) seasons. |
| | Metric 6: | Spatial and Temporal Variability | Medium | For sediments, 17 different river samples. For fish, five species sampled: 12 individual O. miloticus and 7 individual L. subviridis (smaller numbers of three other species) total across all 17 rivers. No replicates. |
| | Metric 7: | Exposure Scenario | High | Parent chemical concentration in fish muscle evaluated by species; feeding habits of species discussed. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Mean and range of chemical concentrations in sediment samples for each river and season reported in Supplemental materials. Mean and range reported for fish samples by species from all collection locations combined. No raw data. |
| | Metric 9: | Quality Assurance | High | Two calibration curves; recovery and precision evaluated; sample concentrations corrected for recovery; duplicate analysis; spiked samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Inter- and intra-day variation of spiked phthalates in sediment and fish samples evaluated (<12%). Compared concentrations with wither quality parameters, chemical parameters, and fish species. Some characterization of variance with range and discussion of uncertainties/data gaps/limitations |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Itoh, H., Yoshida, K., Masunaga, S. (2007). Quantitative identification of unknown exposure pathways of phthalates based on measuring their metabolites in human urine. Environmental Science & Technology 41(13):4542-4547. |
| **HERO ID:** | 675229 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology reported in terms of sampling equipment, procedures, sample storage and study site (city, country). Insufficient information regarding duration of sample storage prior to analysis of urinary phthalates. |
| | Metric 2: | Analytical Methodology | High | Analytical methodology described in terms of extraction, analytical instrumentation, calibration, chemical-specific limits of detection (LOD, supplemental material), recoveries, and creatinine-adjustment of urine specimens. Methodology referenced (Itoh et al., Silva et al.) |
| | Metric 3: | Biomarker Selection | High | Sampling for metabolites specific to parent chemicals. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Urine spot samples provided by participants described as mostly from the Tokyo-Yokohama area of Japan. |
| | Metric 5: | Currency | Low | Samples collected May-June 2004. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Authors described participants as mostly from the Tokyo-Yokohama area of Japan. Sampling conducted only May-June 2004. Single spot urine specimen provided by each participant. A total of 36 participants provided samples. |
| | Metric 7: | Exposure Scenario | Medium | Participant demographic characteristics gathered from questionnaire summarized. Potential sources of exposure discussed, although authors acknowledged further study is necessary to determine unknown exposure pathways. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Data described in terms of location and dates of sampling, median concentration, geometric standard deviation, number of samples, frequency of detection (supplementary material). Insufficient information regarding raw data for each participant. |
| | Metric 9: | Quality Assurance | Medium | Quality assurance details of utilizing one method blank in each analytical batch, recoveries, creatinine adjustment and reproducibility reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Statistical summary measures of variation reported. Background contamination of samples considered within laboratory blank analyses. Limitations briefly discussed. |
| **Overall Quality Determination** | | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | Koo, H. J., Lee, B. M. (2005). Human monitoring of phthalates and risk assessment. Journal of Toxicology and Environmental Health, Part A: Current Issues 68(16):1379-1392. |
| **HERO ID:** | 675256 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Most sampling methodology key criteria met. Insufficient information regarding duration of urine sample storage. |
| | Metric 2: | Analytical Methodology | High | High. Analytical methodology key criteria met and LOD's reported |
| | Metric 3: | Biomarker Selection | N/A | N/A. Sampling for parent chemical of interest |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Korea |
| | Metric 5: | Currency | Low | Low. Sampling May 2003 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Medium. N=300 subjects, single urine specimens. Non-statistical sampling approach. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Demographic characteristics reported. Occupational info lacking. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Main summary statistics reported. Raw data lacking |
| | Metric 9: | Quality Assurance | Medium | Medium. Some key QA parameters reported, recoveries high |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Low. Only mean, 95 %iles reported, no limitation discussion |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Tan, B. L., Hawker, D. W., Muller, J. F., Leusch, F. D., Tremblay, L. A., Chapman, H. F. (2007). Modelling of the fate of selected endocrine disruptors in a municipal wastewater treatment plant in South East Queensland, Australia. Chemosphere 69(4):644-654. |
| **HERO ID:** | 675442 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Critically Deficient | sampling methodology for the primary data from Table 3 not discussed specifically |
| | Metric 2: | Analytical Methodology | Critically Deficient | analytical methods for the primary data from Table 3 not discussed specifically |
| | Metric 3: | Biomarker Selection | N/A | the study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | South East Queensland, Australia |
| | Metric 5: | Currency | Low | sampling data not provided; paper published originally in 2006 |
| | Metric 6: | Spatial and Temporal Variability | Critically Deficient | sample size not reported |
| | Metric 7: | Exposure Scenario | High | concentration in effluent and point of discharge from a conventional activated sludge municipal wastewater treatment plant in Australia; influent from both domestic and industrial discharges; effluent discharged into the Brisbane River |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Table 3 provides the measured effluent, point of discharge and 1km downstream concentrations |
| | Metric 9: | Quality Assurance | Low | QA/QC not discussed |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Xie, Z., Ebinghaus, R., Temme, C., Lohmann, R., Caba, A., Ruck, W. (2007). Occurrence and air-sea exchange of phthalates in the Arctic. Environmental Science & Technology 41(13):4555-4560. |
| **HERO ID:** | 675521 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Described air and water samplers which seems appropriate but is not discussed in detail. Missing equipment calibration and storage information. |
| | Metric 2: | Analytical Methodology | Medium | Provide detection limits; used gas chromatography and mass spectrometry (GC-MS). Analytical methods described in another study. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | North Sea to the high Arctic (60° N-85°N); includes map |
| | Metric 5: | Currency | Low | 2004 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 16 water samples and 6 air samples. |
| | Metric 7: | Exposure Scenario | High | Phthalates are known to degrade in water and have long-range atmospheric transport potential so they measured air and seawater samples. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Provided concentration mean, median, minimum, and maximum. Individual raw data points in S1. |
| | Metric 9: | Quality Assurance | High | "The analytical quality of the data was guaranteed through the use of field blanks to derive method detection limits (MDLs), breakthrough testing of air sampling, and the recoveries of surrogates." Recoveries were $> 70\%$ |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Briefly mention uncertainty limit, uncertainty calculated. Provided minimums and maximums so can understand the range of data. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Sathyanarayana, S., Karr, C. J., Lozano, P., Brown, E., Calafat, A. M., Liu, F., Swan, S. H. (2008). Baby care products: possible sources of infant phthalate exposure. Pediatrics 121(2):e260-268. |
| **HERO ID:** | 676348 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most key criteria met, insufficient urine sample storage information. |
| | Metric 2: | Analytical Methodology | Medium | Key criteria met. LOD's reported as range. |
| | Metric 3: | Biomarker Selection | Low | Metabolites not specific for parent chemical. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Urine samples provided by children in MO, MN and CA. |
| | Metric 5: | Currency | Low | 1999-2002. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Urine samples from children in three states, single spot samples, 163 children. |
| | Metric 7: | Exposure Scenario | Medium | Participant demographics reported. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Most key criteria reported, lacking raw data. |
| | Metric 9: | Quality Assurance | Medium | QA parameters briefly discussed, no issues reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability characterized, limitations discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Bauer, M. J., Herrmann, R. (1997). Estimation of the environmental contamination by phthalic acid esters leaching from household wastes. Science of the Total Environment 208(1-2):49-57. |
| **HERO ID:** | 679229 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | sample composition described; leachate collection schedule and process described. Missing a few components such as duration of sample storage |
| | Metric 2: | Analytical Methodology | Low | equipment, extraction, and methods described; no LOD |
| | Metric 3: | Biomarker Selection | N/A | Sampled parent chemicals in domestic waste |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Germany |
| | Metric 5: | Currency | Low | published 1997 and no sample collection date |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 6 or n = 9; 11 different types of waste; no replicates |
| | Metric 7: | Exposure Scenario | Medium | domestic household waste |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | mean, min and max reported. no raw data |
| | Metric 9: | Quality Assurance | Low | quality not discussed |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Fromme, H., Bolte, G., Koch, H. M., Angerer, J., Boehmer, S., Drexler, H., Mayer, R., Liebl, B. (2007). Occurrence and daily variation of phthalate metabolites in the urine of an adult population. International Journal of Hygiene and Environmental Health 210(1):21-33. |
| **HERO ID:** | 679517 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Most key criteria met. Lack of sample duration data. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Most key criteria met. Lack of sample recovery data. |
| | Metric 3: | Biomarker Selection | Low | High. Metabolites not specific for parent chemicals |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Munich, Germany. |
| | Metric 5: | Currency | Medium | Medium. 2005 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Medium. Replicate morning urine samples from 27 female and 23 male subjects in Munich, Germany on 8 consecutive days, for a total of 399 samples. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Demographics of participants reported, participants described as not occupationally exposed to phthalates. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Most key criteria met. Lack of raw data. |
| | Metric 9: | Quality Assurance | Low | Low. Q/A not discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Medium. Characterization of within-subject variability, study limitations not directly discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Fromme, H., Kuchler, T., Otto, T., Pilz, K., Muller, J., Wenzel, A. (2002). Occurrence of phthalates and bisphenol A and F in the environment. Water Research 36(6):1429-1438. |
| **HERO ID:** | 679518 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | surface water collected from various rivers, lake and channels (fig 1) in Germany at 0.2-0.5m from mainstream flow and placed in bottle w sodium azide in the dark at 4C; single sewage treatment plants samples from final effluent; 24 hr composite samples from 5 STP; 31 sludge samples after centrifugation of sludge at STP; sediment collected manually w grab sample from 35 waterways; 10 liquid manure from central tanks of 9 agricultural factories; waste dump and compost water from collecting tanks of 4 dump sites |
| | Metric 2: | Analytical Methodology | High | analytical method discussed in Section 2.2 (p. 1430-1431); detection limit, retention time and ions used in quantification presented in Table 1; mean recoveries given in Table 2 |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Germany (North Rhine–Westphalia, Rheinland–Pfalz, Brandenburg and Berlin) |
| | Metric 5: | Currency | Low | 1997 |
| | Metric 6: | Spatial and Temporal Variability | High | 116 surface water samples, 35 sediments, 39 sewage effluent, and 38 sewage sludges; 10 liquid manure,2 waste-dump, and 2 compost-runoff water; replicate samples (Table 2) |
| | Metric 7: | Exposure Scenario | High | concentrations in surface water, sediment, sewage treatment plant effluents, sewage sludge, dump water and liquid manure from Germany |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | single measurements of DEHP and DBP depicted in Fig 3 (hard to read exact values); mean and range provided in Section 3.2 (p. 1434) |
| | Metric 9: | Quality Assurance | High | Table 2 provides mean recovery. Additional section on QA |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | compares results to previous studies; discusses large variations in results, especially surface water |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Lin, Z. P., Ikonomou, M. G., Jing, H., Mackintosh, C., Gobas, F. A. (2003). Determination of phthalate ester congeners and mixtures by LC/ESI-MS in sediments and biota of an urbanized marine inlet. Environmental Science & Technology 37(10):2100-2108. |
| **HERO ID:** | 680053 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Surficial sediments; handling described; fish seine netted and frozen, muscle dissected and homogenized; sample extraction described. |
| | Metric 2: | Analytical Methodology | High | Reversed-phase liquid chromatography/electrospray ionization mass spectrometry (LC/ESI-MS), described in detail, formed molecular adduct ions with sodium; compared with GC/MS. |
| | Metric 3: | Biomarker Selection | High | Parent chemical concentrations in striped seaperch muscle. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Vancouver Canada; False Creek. |
| | Metric 5: | Currency | Low | Before 2003. |
| | Metric 6: | Spatial and Temporal Variability | Low | Four independent sediment samples from each of 4 different locations; 3 striped bass from each of 3 sampling stations. |
| | Metric 7: | Exposure Scenario | High | Fish muscle concentrations - relevant to human and ecological exposure assessments. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Bar graphs of mean and 1 standard deviation by chemical and by sampling location. |
| | Metric 9: | Quality Assurance | High | Doubly distilled solvents; lab standards, 5-point calibration, criteria for quantitation; 2 procedural blanks per 4 real samples and 1 PE spiked sample; % recovery and precision reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Extensive analysis of variation and uncertainty in analytic methods; moderate consideration of environmental variation and uncertainty. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Parkman, H., Remberg, M. (1995). Phthalates in Swedish sediments. GRA and I(GRA and I):27. |
| **HERO ID:** | 680108 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methods, locations, and maps included. |
| | Metric 2: | Analytical Methodology | Low | Extraction and instrumentation described; LOD approach described but LOD not provided. |
| | Metric 3: | Biomarker Selection | N/A | Sediment. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sweden. |
| | Metric 5: | Currency | Low | 1994 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 6 samples per site for 23 sites. Unclear if there were replicates. |
| | Metric 7: | Exposure Scenario | Low | Sediment samples. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Average and SD, no individual points. |
| | Metric 9: | Quality Assurance | Medium | QA not directly discussed- Clean-up of phthalates prior to analysis reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and uncertainty not discussed, no obvious concerns. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Tsumura, Y., Ishimitsu, S., Saito, I., Sakai, H., Kobayashi, Y., Tonogai, Y. (2001). Eleven phthalate esters and di(2-ethylhexyl) adipate in one-week duplicate diet samples obtained from hospitals and their estimated daily intake. Food Additives and Contaminants 18(5):449-460. |
| **HERO ID:** | 680169 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Food samples were obtained in store or frozen from hospitals. All important details, such as storage conditions and homogenization equipment, were reported with sufficient detail and were scientifically sound. |
| | Metric 2: | Analytical Methodology | High | Phthalates in homogenized food samples were determined using GC/MS, and all important details of instrumentation and methodology were reported, including detection limits. |
| | Metric 3: | Biomarker Selection | N/A | This study was testing for the parent chemical of interest in environmental media (food). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | This study analyzed samples of foodstuffs available in Osaka, Japan, and duplicate diet samples from hospitals in Osaka, Aichi, and Niigata, Japan. |
| | Metric 5: | Currency | Low | Duplicate diet samples were collected in October or December 1999; date of collection of foodstuffs samples was not specified, but can be inferred to have similar timing. The study was published in 2001. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Four types of foodstuff samples and one-week duplicate diet samples were analyzed in this study. Use of replicates was not reported. |
| | Metric 7: | Exposure Scenario | High | The foodstuffs and duplicate diets were obtained the same way a consumer would obtain them and represent highly relevant scenarios of exposure. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data are not reported; each datum is the average of three trials. |
| | Metric 9: | Quality Assurance | High | QA/QC methods included performing each analysis in triplicate, use of blanks, and determination of recoveries. All recoveries were within acceptable ranges. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Quantitative characterization of variability is absent. Qualitative characterization of variability by food source is discussed. The only limitation/source of uncertainty discussed is the inherent difference between hospital meals and food in the general population as a representation of phthalate sources. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Wienecke, J., Kruse, H., Huckfeldt, U., Eickhoff, W., Wassermann, O. (1995). Organic compounds in the flue gas of a hazardous waste incinerator. Chemosphere 30(5):907-913. |
| **HERO ID:** | 680206 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | sampled taken in September from stack of second combustion line under isokinetic conditions; extracted by a titanium probe nozzle,followed by a titanium bend; further details provided in Materials and Methods section (first paragraph) |
| | Metric 2: | Analytical Methodology | Low | separated by capillary gas chromatography, characterized andquantified by mass spectroscopy; detection or reporting limit not provided |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in the flue gas of an incinerator |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Biebesheim, Germany |
| | Metric 5: | Currency | Low | Sep-92 |
| | Metric 6: | Spatial and Temporal Variability | Low | sampled in September; 2 samples; no replicates |
| | Metric 7: | Exposure Scenario | Medium | Study measured organic compounds in the flue gas of a hazardous waste incinerator. The data can represent a relevant exposure scenario, but chemical levels in flue gas can disperse in the atmosphere; these concentrations may be an overestimate. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 5 provides concentration per sample; no other stats provided |
| | Metric 9: | Quality Assurance | High | discusses standard of recovery; blanks used |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | compared to other studies; little characterization of variance and some discussion of uncertainty |

## Overall Quality Determination Medium

**Study Citation:** Fromme, H., Gruber, L., Schlummer, M., Wolz, G., Bohmer, S., Angerer, J., Mayer, R., Liebl, B., Bolte, G. (2007). Intake of phthalates and di(2-ethylhexyl)adipate: Results of the Integrated Exposure Assessment Survey based on duplicate diet samples and biomonitoring data. Environment International 33(8):1012-1020.

**HERO ID:** 680285

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Study recruited 50 persons among employees of INES and relatives near Munich (possibly biased sample). Required consumption of "normal" diet. Participants trained to collect a duplicate diet daily (7 days) for chemical analyses. |
| | Metric 2: | Analytical Methodology | Medium | PLE and GC/MS, LC/MS/MS, and LC-MS in SRM mode. Confidence might be higher or lower depending on analytic methods paper submitted for publication by Gruber et al. in 2007. |
| | Metric 3: | Biomarker Selection | N/A | HERO 198184 reports urinalysis (biomarkers of exposure) for same population. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Germany. |
| | Metric 5: | Currency | Medium | 2005 |
| | Metric 6: | Spatial and Temporal Variability | High | 50 German adults (27 female 23 male) from city, suburban, and rural areas in or near Munich; participants collected daily duplicate diets over 7 consecutive days for a total of 50 x 7 = 350 diet samples. |
| | Metric 7: | Exposure Scenario | High | Phthalates in diet and amount consumed. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Concentrations in food not reported. Individual BBP intake estimated as median of 7 daily results; Table 2 lists min, max, median, and 95th percentile of the 50 individual median intakes. |
| | Metric 9: | Quality Assurance | Medium | Replicate samples of homogenized food for one day, triplicate aliquots, LODs reported. QA not discussed in current report. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Relative contribution of measurements to uncertainty and variation in calculated BBP intakes not discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Preston, M. R., Al-Omran, L. A. (1989). Phthalate ester speciation in estuarine water, suspended particulates and sediments. Environmental Pollution 62(2-3):183-194. |
| **HERO ID:** | 680380 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | water and sediment samples collected from river bank at three sampling sites (fig 1); water samples collected using apparatus described in earlier paper (Preston, 1986) or by hand; surface sediments collected from two sites (Runcorn and Speke) with a stainless steel spatula ad placed in jars with foil lined caps; |
| | Metric 2: | Analytical Methodology | Low | extracted from the filters in a Soxhlet apparatus; Dissolved phthalates were extracted from water by solvent extractionwith dichloromethane; GC/ECD and GC-MS; limits not reported |
| | Metric 3: | Biomarker Selection | N/A | NA - Water, suspended particles in water, and sediments. No biomarker needed |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | River Mersey Estuary, Liverpool, UK |
| | Metric 5: | Currency | Low | 1-Oct-86 |
| | Metric 6: | Spatial and Temporal Variability | Low | surface water: 3 sampling sites; 6 samples total; collected on one day (October 1); sediment: 2 sampling sites; unclear if replicate samples |
| | Metric 7: | Exposure Scenario | Medium | setting not described; contamination in river water and sediment |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 1 provides dissolved and particulate concentration by sample number; Table 4 shows concentrations in surface sediment |
| | Metric 9: | Quality Assurance | Low | no recoveries; QA/QC not directly discussed |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | compares findings to previous studies |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Vitali, M., Guidotti, M., Macilenti, G., Cremisini, C. (1997). Phthalate esters in freshwaters as markers of contamination sources: A site study in Italy. Environment International 23(3):337-347. |
| **HERO ID:** | 680447 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | levels measured in surface water and sediments of rivers and lakes of central Italy (fig 1); collected in 3 series by glass bottles in surficial layer (0-20cm); stored at 4C in dark; sediment collected in stainless steel corer; top 10cm layer, dried, ground to powder, homogenized, and stored at 4C in dark |
| | Metric 2: | Analytical Methodology | High | water samples extracted by liquid/liquid partitioning (EPA methods); 25 g dry weight sediment sonicated for 20 mi with methylene chloride (EPA methods); GC/MS; mean recoveries (Table 1); MDQ and LMD (Table 2) |
| | Metric 3: | Biomarker Selection | N/A | Measured parent chemicals in river water and sediment |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Rieti District, central Italy |
| | Metric 5: | Currency | Low | 1994; collected in 3 series |
| | Metric 6: | Spatial and Temporal Variability | Medium | 22 sampling points (fig 1); 3 series of water samples for all sampling points (June-July; Aug; and Sept-Oct); sediment samples from 13 points. No replicates |
| | Metric 7: | Exposure Scenario | High | sampling surface water and sediment from rivers and lakes of selected areas impacted by industrial plants, wastewater treatment plants, and cities; sites of different typology (urban, industrial, agricultural, and open country |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 3 provides results of the three sampling periods per sampling point. Missing most summary statistics |
| | Metric 9: | Quality Assurance | Medium | mean recoveries and relative std deviation reported in Table 1; results are in good agreement with those reported in the literature and standard methods. Recoveries >70% for all chemicals of interest except in sediments for BBP (65%), but no indication of correction |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | discussed significant problems using sodium sulfate and glass-fiber filters and how treated with organic solvents so no PAEs were detected in procedure blanks; discussed variability between sampling locations and over time; compared findings to previous studies (Table 4). No characterization of variance but raw data are available to calculate |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Zeng, F., Cui, K., Xie, Z., Wu, L., Liu, M., Sun, G., Lin, Y., Luo, D., Zeng, Z. (2008). Phthalate esters (PAEs): Emerging organic contaminants in agricultural soils in peri-urban areas around Guangzhou, China. Environmental Pollution 156(2):425-434. |
| **HERO ID:** | 680472 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling equipment and methods are described in sufficient detail, but certain aspects (e.g. duration of storage) were absent that are unlikely to have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | Low | Analytical instrumentation and methods are described in sufficient detail, but limits of detection are only provided as a range for all analytes, not just the chemical of interest. |
| | Metric 3: | Biomarker Selection | N/A | This study is testing for the parent chemical of interest in an environmental medium. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | 2006 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Single soil samples were taken from 40 sites across 5 districts (n = 4 or greater for each district). No replicates were collected. |
| | Metric 7: | Exposure Scenario | High | Soil locations from which samples were collected are very well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data are not reported; summary statistics include the detection frequency, minimum, maximum, mean, and median concentration for each district. |
| | Metric 9: | Quality Assurance | High | QA/QC measures included the use of blanks, spike recoveries, surrogate standards, and sample duplicates. Corrections were made based on detectable levels found in procedural blanks, and recoveries were within acceptable ranges. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Relative standard deviation was reported as a a range for all analytes, spatial variation between districts is discussed in depth, and there is some discussion of uncertainty. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Zeng, F., Cui, K., Xie, Z., Wu, L., Luo, D., Chen, L., Lin, Y., Liu, M., Sun, G. (2009). Distribution of phthalate esters in urban soils of subtropical city, Guangzhou, China. Journal of Hazardous Materials 164(2-3):1171-1178. |
| **HERO ID:** | 680473 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | All key sampling methods reported |
| | Metric 2: | Analytical Methodology | High | All key analytical methods reported |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Guangzhou, China |
| | Metric 5: | Currency | Medium | Samples collected in 2005 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples, no replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | raw data not provided |
| | Metric 9: | Quality Assurance | High | Key QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Mihovec-Grdić M, Smit Z, Puntarić D, Bosnir J (2002). Phthalates in underground waters of the Zagreb area. Croatian Medical Journal 43(4):493-497. |
| **HERO ID:** | 682057 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | analyzed 96 water samples divided into three groups - 1) underground waters of the Sava river alluvium (n=77) collected from pipeline bores at 4 sites; 2) Sava river as the main source supplying water to the Sava alluvium (n=10), 3) drinking water collected from the water supply network and captages (n=10); underground water sampling sites and locations of solid waste disposal in the Zagreb area (fig 1). Missing some information on methodology (e.g., sampling equipment, storage conditions/duration) |
| | Metric 2: | Analytical Methodology | Low | extraction from neutral and acidic samples using high rpm mixer; GC-ECD. Mo mention of recoveries. Abstract noted that detection limit was 0.005 ug/L, which initially sounded like it applied broadly to all of the phthalates of interest. However, last sentence of Materials and Methods indicated that one phthalate had a higher detection limit; it's unclear what the situation is for the other ones. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in underground waters. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Zagreb, Croatia |
| | Metric 5: | Currency | Low | between February and June 1998 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 96 samples between February and June. No replicates |
| | Metric 7: | Exposure Scenario | High | contamination in underground waters and tap water due to proximity of waste dump |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 1 provides pooled concentration by water source; n, DF, min, max, and mean provided. No raw data |
| | Metric 9: | Quality Assurance | Low | QA/QC not directly discussed |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | discuses variation between sites and compared findings to previous studies. Some characterization of variance and discussion of uncertainty, limitations, and gaps. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Klamer, H. J., Leonards, P. E., Lamoree, M. H., Villerius, L. A., Kerman, J. E., Bakker, J. F. (2005). A chemical and toxicological profile of Dutch North Sea surface sediments. Chemosphere 58(11):1579-1587. |
| **HERO ID:** | 683627 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | locations and site descriptions provided, box-core samples pooled |
| | Metric 2: | Analytical Methodology | Medium | Irgarol 1051 analyses (Steen et al., 1997; Lamoree et al., 2002); DL in text |
| | Metric 3: | Biomarker Selection | N/A | sediment |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The Netherlands |
| | Metric 5: | Currency | Low | 2000 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 10 sites one pooled sample per site, no replicates |
| | Metric 7: | Exposure Scenario | Low | estuaries, harbours, coastal zones |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | raw data |
| | Metric 9: | Quality Assurance | Low | QA not described, no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not described, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Irvin, E., Calafat, A., Silva, M., Aguilar-Villalobos, M., Needham, L., Hall, D., Cassidy, B., Naeher, L. (2010). An estimate of phthalate exposure among pregnant women living in Trujillo, Peru. Chemosphere 80(11):1301-1307. |
| **HERO ID:** | 697305 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | recruitment and sampling described |
| | Metric 2: | Analytical Methodology | Medium | LOD reported, refers to other publications (Kato et al., 2005; Silva et al.,2007) |
| | Metric 3: | Biomarker Selection | High | metabolite |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Peru |
| | Metric 5: | Currency | Low | 2004 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 79 women, no replicates |
| | Metric 7: | Exposure Scenario | High | bio monitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | mean, 95% confidence interval |
| | Metric 9: | Quality Assurance | Medium | Quality control was assured using calibration standards, reagentblanks, and quality control materials of high and low concentrations during each analytical run. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Yan, X., Calafat, A., Lashley, S., Smulian, J., Ananth, C., Barr, D., Silva, M., Ledoux, T., Hore, P., Robson, M. (2009). Phthalates biomarker identification and exposure estimates in a population of pregnant women. Human and Ecological Risk Assessment 15(3):565-578. |
| **HERO ID:** | 697308 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | approved by the Institutional Review Board(IRB) at Rutgers University and the Centers for Disease Control and Prevention (CDC). |
| | Metric 2: | Analytical Methodology | Medium | LODs in Table 2, method by David (2000) as expressed by Koch et al. (2003a) |
| | Metric 3: | Biomarker Selection | High | metabolite |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | U.S. |
| | Metric 5: | Currency | Low | published 2009 |
| | Metric 6: | Spatial and Temporal Variability | High | 150 women, no replicates (sample size varies depending on chemical) |
| | Metric 7: | Exposure Scenario | High | bio monitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | arithmetic mean, SE, median, 95th percentile, range |
| | Metric 9: | Quality Assurance | Medium | Ten percent of all samples collected were quality assurance samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Suzuki, Y., Niwa, M., Yoshinaga, J., Mizumoto, Y., Serizawa, S., Shiraishi, H. (2010). Prenatal exposure to phthalate esters and PAHs and birth outcomes. Environment International 36(7):699-704. |
| **HERO ID:** | 697317 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | not much sampling detail |
| | Metric 2: | Analytical Methodology | Low | The detailed analytical methods were described in Suzuki et al. (2009); LOD in table 2 |
| | Metric 3: | Biomarker Selection | High | Study presents metabolites. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Japan |
| | Metric 5: | Currency | Medium | 2005-2008 |
| | Metric 6: | Spatial and Temporal Variability | Low | n = 149, no replicates, urine spot samples |
| | Metric 7: | Exposure Scenario | High | bio metric |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | min, max, GM, 25th, 50th, 75th, detection rate |
| | Metric 9: | Quality Assurance | High | Internal quality control of the urinary metabolite analyses wascarried out by periodical blank measurement, recovery test and theanalysis of intra-laboratory reference urine samples. Moreover, ourlaboratory took part in Intercomparison Programme 40 of the German External Quality Assessment Scheme in 2007 for some phthalate ester metabolites |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Discussed in section 4.4, no obvious concerns. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Kondo, F., Ikai, Y., Hayashi, R., Okumura, M., Takatori, S., Nakazawa, H., Izumi, S., Makino, T. (2010). Determination of five phthalate monoesters in human urine using gas chromatography-mass spectrometry. Bulletin of Environmental Contamination and Toxicology 85(1):92-96. |
| **HERO ID:** | 697322 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | 36 participants were all staff from one institute of public health (Aichi Prefectural); ages and sex reported; selection criteria not listed; urine collection by participants not described. |
| | Metric 2: | Analytical Methodology | High | Described in detail; urine samples spiked with radiolabeled standards; GC-MS; calibration curves reproducible and linear. |
| | Metric 3: | Biomarker Selection | Medium | Monoester metabolite measured in urine; however, creatinine in urine sample not measured (estimated from equation incorporating age, body weight, and height). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Japan, Nagoya |
| | Metric 5: | Currency | Low | Sampling year not reported; likely between 2005 and 2010 according to publication year of 2010. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Urine from 36 people; however, all on staff at same institute. No scenario description. |
| | Metric 7: | Exposure Scenario | Low | Exposure scenarios not described; presumably ”general” Japanese adult exposure from all sources. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Reported frequency of detection (out of 36 urine samples) and concentration, median and range, per (a) unit volume and (b) modeled (not measured) creatinine mass in urine. |
| | Metric 9: | Quality Assurance | High | Methods development: optimized quality of results before analyzing urine. LOD, % recovery with radiolabeled standards, quintuplicate blanks, LOQ, minimal contamination. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Measurement variation and uncertainty quantified; variation among single urine samples from 36 individuals represented by median and range only. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Kanazawa, A., Saito, I., Araki, A., Takeda, M., Ma, M., Saijo, Y., Kishi, R. (2010). Association between indoor exposure to semi-volatile organic compounds and building-related symptoms among the occupants of residential dwellings. Indoor Air 20(1):72-84. |
| **HERO ID:** | 697390 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methods were described in detail. There is additional follow-up information in Takeda et al., 2009 and Kishi et al., 2009. Air sampling was performed at a height of 1.0–1.5 mfrom a floor and about 1 m from a wall. Dust sampleswere collected using a vacuum cleaner with samples from all over the floor or from multi-surfaces such as tops of doors, shelves, cupboards, and frames. |
| | Metric 2: | Analytical Methodology | High | Analytical methods were described in the appendix. The method detection limits were included. Details regarding equipment information were included. |
| | Metric 3: | Biomarker Selection | N/A | Air and dust samples were collected. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Air and dust sampling for SVOC's was conducted inside residential detached houses of Sapporo, Japan. |
| | Metric 5: | Currency | Medium | Data was collected from October, 2006 through January, 2007. |
| | Metric 6: | Spatial and Temporal Variability | Medium | There were 40 air samples collected during a 48-hour sampling time, as well as 41 multi-surface dust samples, and 41 floor dust samples collected. A single dust sample was obtained from each dwelling, and replicate sampling was not detailed. |
| | Metric 7: | Exposure Scenario | Medium | The potential sources of exposures were briefly described in the text, and Table 3 summarized dwelling characteristics such as wall materials, use of flame retardants and dampness. The temperature and humidity microclimate measures within dwellings were summarized. The use of exposure controls was not detailed. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. Summary statistics were reported in Table 5 with method detection limits and included the median and ranges of measured concentrations along with the number of samples for each chemical. |
| | Metric 9: | Quality Assurance | Medium | The appendix text noted that quality assurance was described in Saito et al., 2007. The use of travel blanks was detailed within the main text. Recoveries were not detailed and baseline, pre-exposure sampling was not conducted. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study characterizes variability within reported chemical concentration summary statistic ranges. Multiple potential key study limitations were discussed, but are unlikely to have had a substantial impact on results. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Liu, H., Liang, H., Liang, Y., Zhang, D., Wang, C., Cai, H., Shvartsev, S. (2010). Distribution of phthalate esters in alluvial sediment: A case study at JiangHan Plain, Central China. Chemosphere 78(4):382-388. |
| **HERO ID:** | 697396 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported |
| | Metric 2: | Analytical Methodology | Low | Detection limits only reported as a range for all chemicals combined. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in soil and sediment |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | HuBei, China |
| | Metric 5: | Currency | Medium | Samples collected in 2007 and 2008 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not provided |
| | Metric 9: | Quality Assurance | Low | Key QA reported, but recoveries appeared low even after correction. See last paragraph of Section 2.6. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported |

## Overall Quality Determination Medium

**Study Citation:** Kim, M., Yun, S., Chung, G. (2009). Determination of phthalates in raw bovine milk by gas chromatography/time-of-flight mass spectrometry (GC/TOF-MS) and dietary intakes. Food Additives & Contaminants: Part A, Chemistry, Analysis, Control, Exposure & Risk Assessment 26(1):134-138.

**HERO ID:** 697442

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | not much detail - 30 different dairy farms in South Korea |
| | Metric 2: | Analytical Methodology | Low | extraction and equipment described; The LODs werecalculated as a signal-to-noise ratio of 3. LODs not provided. |
| | Metric 3: | Biomarker Selection | High | parent in bovine milk |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | South Korea |
| | Metric 5: | Currency | Low | Timing of sample collection for monitoring data is not reported, discussed, or referenced. However publication year of 2009 is used as proxy. |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 30, no replicates |
| | Metric 7: | Exposure Scenario | High | bovine milk |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | mean, min, max, recovery%, detected frequency% provided |
| | Metric 9: | Quality Assurance | Low | QA not discussed, no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Wu, B., Zhang, X., Zhang, X., Yasun, A., Zhang, Y., Zhao, D., Ford, T., Cheng, S. (2009). Semi-volatile organic compounds and trace elements in the Yangtze River source of drinking water. Ecotoxicology 18(6):707-714. |
| **HERO ID:** | 697468 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | concentration in water samples from Yangtze River which is the source of drinking water for Nanjing; source water sampled at tap water plant; 10 L; collected in bottles and placed in ice bath; samples filtered and kept at 4C |
| | Metric 2: | Analytical Methodology | Low | reformative liquid–liquid extraction method; GC/MS and ICP-AES; recovery samples; LODs provided in Table 1 |
| | Metric 3: | Biomarker Selection | N/A | the study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Yangtze River, Nanjing, Jiangsu province, China |
| | Metric 5: | Currency | Medium | 2007 and 2008 |
| | Metric 6: | Spatial and Temporal Variability | Critically Deficient | sampled in Dec 2007 and March, June, Sept and Dec 2008 (over 13 month period); all samples from one location, but sample size not provided |
| | Metric 7: | Exposure Scenario | High | concentration in water samples from Yangtze River which is the source of drinking water for Nanjing; river flows through 11 provinces and 2 major cities; waste water, agricultural run-off and intense industrial and urban activity |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 1 provides mean, std dev, median and range for each chemical |
| | Metric 9: | Quality Assurance | High | reagent blanks, standard reference materials and sample replicates taken; recovery rates were above 74.3$ |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | discusses temporal trends; compares findings to other rivers in China and other countries; std dev reported in Table 1 |

## Overall Quality Determination — Uninformative

| | |
|---|---|
| **Study Citation:** | Peck, J., Sweeney, A., Symanski, E., Gardiner, J., Silva, M., Calafat, A., Schantz, S. (2010). Intra- and inter-individual variability of urinary phthalate metabolite concentrations in Hmong women of reproductive age. Journal of Exposure Science & Environmental Epidemiology 20(1):90-100. |
| **HERO ID:** | 697726 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Cohort substudy. Fox River Environment and Diet Study (FRIENDS) - IRB approved protocol. Briefly described, more information in other references. |
| | Metric 2: | Analytical Methodology | Medium | Samples sent to CDC Division of Laboratory Sciences for processing and analysis. LOD in text MBzP, 0.11 ug/l; MnBP, 0.4 ug/l;MiBP, 0.26 ug/l; MEHP, 0.9 ug/l; |
| | Metric 3: | Biomarker Selection | High | metabolite |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | U.S. - Wisconsin |
| | Metric 5: | Currency | Medium | 2005 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 45, no replicates |
| | Metric 7: | Exposure Scenario | High | urine, women of reproductive age |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | mean, SD, 25th, 50th, 75th, 95th, min and max reported; also reported by different demographics |
| | Metric 9: | Quality Assurance | Medium | Quality control and reagent blank samples were included in each analytical batch along with the study samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Measurement variability was assessed using intraclass correlations (ICCs) and surrogate category analysis. Observed a large degree of variability in phthalate metabolite concentrations across all samples |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Cai, Q., Mo, C., Wu, Q., Zeng, Q., Katsoyiannis, A. (2007). Occurrence of organic contaminants in sewage sludges from eleven wastewater treatment plants, China. Chemosphere 68(9):1751-1762. |
| **HERO ID:** | 698313 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | sludge from 11 WWTPs; grab samples of sludge collected and stored in aluminum containers; samples dried at room temp, ground, sieved, and refrigerated. Missing description or mention of sampling contamination and care of cross contamination and prevention |
| | Metric 2: | Analytical Methodology | High | extraction performed according to USEPA 340C methods; Soxhlet-extractor; GC–MS; detection limits and recoveries presented in Table 1 |
| | Metric 3: | Biomarker Selection | N/A | Wastewater, no biomarker needed |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | 9 different cities throughout China (Beijing, Xi'an, Lanzhou, Wuxi,Guangzhou, Foshan, Shenzhen, Zhuhai and Hong Kong) |
| | Metric 5: | Currency | Low | between 1998 and 1999 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 11 WWTPs sampled around China; Fig 1 provides locations; number of samples per location and duration of sampling not provided, replicates unknown |
| | Metric 7: | Exposure Scenario | High | sewage sludge from WWTPs in China; Table 2 provides sources of the sludge and their characteristics |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | average concentrations by WWTP is presented in Table 4; percentage of total concentration provided; all other parameters/stats not provided |
| | Metric 9: | Quality Assurance | Medium | quality assurance/quality control (QA/QC) have been presented elsewhere (Cai et al., 2007a); % recoveries provided in Table 1 |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | discusses variance by plant |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Cai, Q., Mo, C., Wu, Q., Zeng, Q., Katsoyiannis, A. (2007). Quantitative determination of organic priority pollutants in the composts of sewage sludge with rice straw by gas chromatography coupled with mass spectrometry. Journal of Chromatography A 1143(1-2):207-214. |
| **HERO ID:** | 698352 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The sampling methodology is clear, detailed, and appropriate. Details such as sampler calibration and sample storage are provided. |
| | Metric 2: | Analytical Methodology | High | The analytical methodology is clear, detailed, and appropriate; detection limits are provided in Table 1. |
| | Metric 3: | Biomarker Selection | N/A | Study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in China. |
| | Metric 5: | Currency | Low | Publication date is 2007. No sample collection date provided. |
| | Metric 6: | Spatial and Temporal Variability | Low | Only four samples were collected (1 per compost type) as shown in Table 2. |
| | Metric 7: | Exposure Scenario | High | The study is testing for chlorobenzenes and phthalates in compost materials. This scenario is of interest for the chemical and is well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Raw data is provided in Table 3. |
| | Metric 9: | Quality Assurance | Medium | QA/QC measures are discussed, including the use of blanks and controls. QA/QC issues were not identified. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No characterization of variability or uncertainty is provided. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Zhu, J., Phillips, S., Feng, Y., Yang, X. (2006). Phthalate esters in human milk: concentration variations over a 6-month postpartum time. Environmental Science & Technology 40(17):5276-5281. |
| **HERO ID:** | 698399 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling equipment and methods are described in sufficient detail and are scientifically sound. |
| | Metric 2: | Analytical Methodology | High | Analytical instrumentation and methods are described in sufficient detail and are scientifically sound. Detection limit is reported. |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical of interest in a medium which is environmental to the exposure population (infants). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Canada |
| | Metric 5: | Currency | Low | 2003-2004 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 86 breastmilk samples were collected from 21 women across five timepoints postpartum. |
| | Metric 7: | Exposure Scenario | High | The exposure to infants is highly relevant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data are not reported; summary statistics include detection frequency, geometric mean, arithmetic mean and 95% confidence interval, median, maximum, and percentiles (25, 75, 95) of concentration. |
| | Metric 9: | Quality Assurance | Medium | QA/QC measures included duplicate analysis of select samples, use of internal standards. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Metrics of variability are reported, temporal variation is thoroughly discussed, and there are minimal concerns for uncertainties. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Lin, S., Ku, H., Su, P., Chen, J., Huang, P., Angerer, J., Wang, S. (2011). Phthalate exposure in pregnant women and their children in central Taiwan. Chemosphere 82(7):947-955. |
| **HERO ID:** | 699479 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most key criteria met, storage duration data lacking. |
| | Metric 2: | Analytical Methodology | Medium | Most key criteria met, LOD's not reported. |
| | Metric 3: | Biomarker Selection | Low | Metabolites not specific for parent chemicals. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Taiwan |
| | Metric 5: | Currency | Low | Sampling in 2001-2002. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Single samples, but multiple media and sampling at multiple ages for offspring and random selection of participants. |
| | Metric 7: | Exposure Scenario | Medium | Participant characteristics reported. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Most key criteria met, lacking raw data. |
| | Metric 9: | Quality Assurance | Low | Q/A briefly mentioned, most key criteria missing, however training of collection procedures for milk samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Statistical characterization of variability, study limitations not discussed. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Itoh, H., Iwasaki, M., Hanaoka, T., Sasaki, H., Tanaka, T., Tsugane, S. (2009). Urinary phthalate monoesters and endometriosis in infertile Japanese women. Science of the Total Environment 408(1):37-42. |
| **HERO ID:** | 699484 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | High. Key criteria met |
| | Metric 2: | Analytical Methodology | Low | Low. Most key criteria met. Calculation of LODs was explained but actual LODs not reported. |
| | Metric 3: | Biomarker Selection | Low | Low. Metabolites not specific for parent chemicals. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Japan |
| | Metric 5: | Currency | Low | Low. Samples collected 2000-2001 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Medium. Single spot urine samples from 137 participants, non-statistical sampling approach. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Participant demographics reported. While source of exposure and other factors not described, they are less relevant to this epidemiological study. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Most key criteria met. Lack of raw data. |
| | Metric 9: | Quality Assurance | Medium | Medium. Q/A procedures reported, most key criteria met. No recoveries |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Low. Statistical variability characterized, study limitations discussed. Some concern for duration of sample storage prior to analysis and repeated thawing of samples, but unlikely to substantially affect results. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Lin, L., Wang, S., Chang, Y., Huang, P., Cheng, J., Su, P., Liao, P. (2011). Associations between maternal phthalate exposure and cord sex hormones in human infants. Chemosphere 83(8):1192-1199. |
| **HERO ID:** | 699485 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Most key criteria met. Lack of sample storage/duration data. |
| | Metric 2: | Analytical Methodology | High | High. Key criteria met. LOD's reported. |
| | Metric 3: | Biomarker Selection | Low | Low. Metabolites not specific for parent chemicals |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Taiwan |
| | Metric 5: | Currency | Low | Low. Samples collected 2000-2001. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Single spot urine samples from 155 women in non-statistical sampling approach. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Population demographics reported and included work history in chemical factories. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Most key criteria met (Table 2), lacking raw data |
| | Metric 9: | Quality Assurance | Medium | Medium. Q/A not detailed, however laboratory accuracy program |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Medium. Statistical variability characterized, study limitations (assumptions, misclassification of exposure potential) discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Ligocki, M. P., Leuenberger, C., Pankow, J. F. (1985). Trace organic compounds in rain{\textemdash}II. Gas scavenging of neutral organic compounds. Atmospheric Environment 19(10):1609-1617. |
| **HERO ID:** | 724845 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The sampling method was sound. |
| | Metric 2: | Analytical Methodology | Low | Detection limits were not reported. |
| | Metric 3: | Biomarker Selection | N/A | the study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Portland, Oregon |
| | Metric 5: | Currency | Low | Study was conducted in the winter and spring of 1984. |
| | Metric 6: | Spatial and Temporal Variability | Medium | The study reported 7 rain events during which samples were collected. |
| | Metric 7: | Exposure Scenario | Medium | The data likely represent the relevant exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Individual sample concentrations were reported. One rain event represented one sample. |
| | Metric 9: | Quality Assurance | Medium | The study applied and documented quality assurance/quality control measures; however, one or more pieces of QA/QC information is not described. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study has limited discussion of key uncertainties, limitations, and data gaps. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Woodruff, T. J., Zota, A. R., Schwartz, J. M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119(6):878-885. |
| **HERO ID:** | 755656 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The articles uses data from the NHANES database, which is a nationally representative survey. |
| | Metric 2: | Analytical Methodology | High | The analysis was conducted using SUDAAN and SAS, with descriptive statistics method referenced. |
| | Metric 3: | Biomarker Selection | High | Biomarkers are known to be related with external exposure. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in the USA. |
| | Metric 5: | Currency | Medium | NHANES samples were from 2003-2004. |
| | Metric 6: | Spatial and Temporal Variability | Low | 1757 total samples from pregnant and nonpregnant women were taken. No replicates were reported. |
| | Metric 7: | Exposure Scenario | Medium | The data represents pregnant women's exposure to chemicals. However, the study doesn't give information about sources. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics reported. Full data can be found on NHANES. |
| | Metric 9: | Quality Assurance | High | NHANES study undergoes QA/QC procedures. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Characterized variability, limited discussion of uncertainties and limitations |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Kasper-Sonnenberg, M., Koch, H. M., Wittsiepe, J., Wilhelm, M. (2012). Levels of phthalate metabolites in urine among mother-child-pairs - Results from the Duisburg birth cohort study, Germany. International Journal of Hygiene and Environmental Health 215(3):373-382. |
| **HERO ID:** | 787906 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most key criteria met. Duration of sample storage prior to analysis lacking. |
| | Metric 2: | Analytical Methodology | Medium | Most key criteria met, analytical methodology referenced, LOQs reported as range. |
| | Metric 3: | Biomarker Selection | Low | Sampling for metabolites not specific for parent chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples provided by participants in Duisburg, Germany. |
| | Metric 5: | Currency | Medium | Sampling conducted 2007-2009. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Single urine samples provided by n=105 children and n=104 mothers, first-morning urine sampling, non-statistical sampling methods. |
| | Metric 7: | Exposure Scenario | Medium | Participant characteristics summarized, occupational status unknown, lack of exposure controls. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Most key criteria met. Lack of raw data. |
| | Metric 9: | Quality Assurance | Low | Quality assurance details not reported, however analytic methodology referenced. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Characterization of variability depicted within exposure summary statistics. Some limitations discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Liu, L., Bao, H., Liu, F., Zhang, J., Shen, H. (2012). Phthalates exposure of Chinese reproductive age couples and its effect on male semen quality, a primary study. Environment International 42(1):78-83. |
| **HERO ID:** | 787928 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Most key criteria met. Duration of sample storage prior to analysis lacking. |
| | Metric 2: | Analytical Methodology | High | High. Key criteria met, LOD's reported. |
| | Metric 3: | Biomarker Selection | Low | Low. Metabolite not specific for parent chemical |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | Medium. Samples collected 2009-2010 |
| | Metric 6: | Spatial and Temporal Variability | Low | Low. Two spot urine samples from each of 150 participants |
| | Metric 7: | Exposure Scenario | Medium | Medium. Participant demographics reported |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Most key criteria met, raw data lacking |
| | Metric 9: | Quality Assurance | Medium | Medium. Q/A parameters reported, most key criteria met. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Medium. Statistical characterization of variability, limitations due to small sample size briefly mentioned. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Guo, Y., Wu, Q., Kannan, K. (2011). Phthalate metabolites in urine from China, and implications for human exposures. Environment International 37(5):893-898. |
| **HERO ID:** | 787930 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Spot urine samples; stored frozen; sample size reported by location, age, sex; "subpopulations" listed. |
| | Metric 2: | Analytical Methodology | High | Described in detail for each urinary metabolite. Deconjugation then SPE. ESI-MS/MS. LOQ reported; C13-radiolabeled standards used. |
| | Metric 3: | Biomarker Selection | Medium | MBZBP in urine; not normalized to creatine by individual. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China; cities of Shanghai, Qiqihaer, and Guangzhou. |
| | Metric 5: | Currency | Medium | 2010, May through July. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Urine spot samples. More than 10 males and 10 females sampled per city; more than 30 individuals aged 20-40 and aged $>$ 40 of each sex included. |
| | Metric 7: | Exposure Scenario | Medium | Exposure scenario not defined; all sources and routes. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Reported % detected, range, geometric and arithmetic means, and quartiles by sex, city, and age group. Graphically presented 10th and 90th percentiles and individual data points above and below those percentiles. |
| | Metric 9: | Quality Assurance | High | For each batch of 30 samples, 2 method blanks, spiked blank, 1 pair matrix spiked samples, and duplicates; reported recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Discussion compared metabolites across cities by sex and age group, also across published reports; variance bars by city (Figure 3). No discussion of limited sample size. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Casas, L., Fernández, M. F., Llop, S., Guxens, M., Ballester, F., Olea, N., Irurzun, M. B., Rodríguez, L. S., Riaño, I., Tardón, A., Vrijheid, M., Calafat, A. M., Sunyer, J., INMA Project (2011). Urinary concentrations of phthalates and phenols in a population of Spanish pregnant women and children. Environment International 37(5):858-866. |
| **HERO ID:** | 787931 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Urine was collected in 100 mL non-vinyl and nonpolycarbonatecontainers and stored at −20 °C. One aliquot of eachselected individual was shipped to the CDC Environmental HealthLaboratories, and aliquots were stored at or below −20 °C. All urine samples were stored for a minimum of one year and a maximum of 5 years before analysis. |
| | Metric 2: | Analytical Methodology | High | The analytical methodology is described. Table 1. Limits of detection (LOD) for phthalate metabolites and phenols in urine (ng/mL). |
| | Metric 3: | Biomarker Selection | High | Monobenzyl phthalate. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Spain. |
| | Metric 5: | Currency | Medium | 2004-2008. |
| | Metric 6: | Spatial and Temporal Variability | Medium | No sample replicates. 120 women and 30 children. |
| | Metric 7: | Exposure Scenario | High | Phthalate and phenol exposure is prevalent among the general population and of potential concern for pregnant women and children because of their suspected susceptibility to endocrine effects. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No individual samples reported. Table 2. Urinary concentrations of phthalate and phenol metabolites (ng/mL) during pregnancyand childhood. Median IQR. |
| | Metric 9: | Quality Assurance | Medium | The only QC reported was the potential cross contamination due to the storage containers. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Uncertainty due to the long storage time and possible cross contamination. Variability reported in summary of statistics (IQR). |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Frederiksen, H., Aksglaede, L., Sorensen, K., Skakkebaek, N. E., Juul, A., Andersson, A. M. (2011). Urinary excretion of phthalate metabolites in 129 healthy Danish children and adolescents: Estimation of daily phthalate intake. Environmental Research 111(5):656-663. |
| **HERO ID:** | 787933 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Instruction for self-urine collection, storage, and transport described. |
| | Metric 2: | Analytical Methodology | High | Described in detail. Isotope dilution LC/MS with preceding enzymatic deconjugation followed by SPE. Additional details reported in Frederiksen et al. 2010 (HERO 697294). |
| | Metric 3: | Biomarker Selection | High | MBzP in urine analyzed. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Denmark |
| | Metric 5: | Currency | Medium | 2007, November |
| | Metric 6: | Spatial and Temporal Variability | High | 129 healthy Danish youths from Copenhagen area only: 65 boys, 64 girls, with n > 10 of each sex for each of three age groups: 6-10, 11-16, 17-21 years. One 24-hr and two first morning urine samples. |
| | Metric 7: | Exposure Scenario | Medium | Boys and girls in three different age groups; all sources and routes of exposure. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Reported concentration of MBzP in urine for all 129 individuals as min, max, and percentiles (Table 1). Reported median excretion of MBzP as mass per 24 hours by sex and by age (Figure 2). Estimated BBzP intake (Table 3): median, 95th percentile, and maximum reported. |
| | Metric 9: | Quality Assurance | Medium | Described, included recoveries for spiked samples. Additional details published in Frederiksen et al. 2010 (HERO 697294). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Accuracy and precision of analytic methods over time assessed on spiked urine samples (n = 5 for intra-day variation, and n = 24 for 2-month interval). Discussed uncertainties (e.g., variation in urine storage temp prior to receipt at lab). |

## Overall Quality Determination High

**Study Citation:** Fromme, H., Gruber, L., Seckin, E., Raab, U., Zimmermann, S., Kiranoglu, M., Schlummer, M., Schwegler, U., Smolic, S., Völkel, W. (2011). Phthalates and their metabolites in breast milk - Results from the Bavarian Monitoring of Breast Milk (BAMBI). Environment International 37(4):715-722.

**HERO ID:** 787934

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling equipment and methods are described in sufficient detail, although certain aspects (e.g. duration of storage) are missing that are unlikely to have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | Low | Analytical instrumentation and methods are described in sufficient detail, but LOD for parent diester is missing. |
| | Metric 3: | Biomarker Selection | N/A | The study is measuring the parent chemical. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Germany |
| | Metric 5: | Currency | Medium | Timing was reported as during the study period of the Bavarian Monitoring of Breast Milk (BAMBI) survey without specific years provided; external sources indicate that BAMBI took place 2007-2008. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Samples of breast milk were collected from 78 mothers (one per mother) at 4 to 8 weeks after delivery. No replicates were collected. |
| | Metric 7: | Exposure Scenario | High | The exposure scenario of phthalates in breastmilk is highly relevant to nursing infants |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data points are not reported; summary statistics include the minimum, maximum, median, mean, 90th percentile, and 95th percentile of concentrations. |
| | Metric 9: | Quality Assurance | High | QA/QC measures reported include the use of blanks, references, duplicate or triplicate analyses, and recovery calculations. Only minor issues were identified and subsequently addressed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | No measure of variance is provided, but there is qualitative discussion of limitations/uncertainty. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Guo, Y., Alomirah, H., Cho, H. S., Minh, T. B., Mohd, M. A., Nakata, H., Kannan, K. (2011). Occurrence of phthalate metabolites in human urine from several Asian countries. Environmental Science & Technology 45(7):3138-3144. |
| **HERO ID:** | 787935 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some sampling methods not reported such as sample storage conditions. |
| | Metric 2: | Analytical Methodology | High | All key analytical methods reported. LOQ reported on lines 96-98 of SI. |
| | Metric 3: | Biomarker Selection | High | mBzP was the metabolite for BBP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Seven Asian countries were reported - China, India, Japan, Korea, Kuwait, Malaysia, and Vietnam. |
| | Metric 5: | Currency | Medium | Samples collected in 2010 for all countries except Korea, which were collected during 2006-2007. |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicates. |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported. |
| | Metric 9: | Quality Assurance | High | Key QA measures reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Gaps and limitations characterized. Variance presented with ranges in Table S3. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Marcus, M., Christensen, K. Y., Manatunga, A., Rudra, C. B., Brock, J. W., Small, C. M. (2010). Variability of phthalate monoester levels in daily first-morning urine from adult women: A pilot study. Reviews on Environmental Health 25(4):359-368. |
| **HERO ID:** | 787937 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The study authors reported sampling methods, participant demographics and sample storage. |
| | Metric 2: | Analytical Methodology | Medium | The study authors reported analytical methods, instrument and LOD. Recovery samples were not reported. |
| | Metric 3: | Biomarker Selection | Medium | The biomarkers used were acceptable. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in the United States (New York and Boston). |
| | Metric 5: | Currency | Low | The participants were recruited between 1990 and 1993. |
| | Metric 6: | Spatial and Temporal Variability | Low | 10 women were studied with no replicate samples. |
| | Metric 7: | Exposure Scenario | Medium | The data were collected from a monitoring survey and were not linked to a specific source of exposure. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported in the study, but the study authors did report descriptive statistics. |
| | Metric 9: | Quality Assurance | Low | The study reported some QA/QC including standards and blanks. Some QA was not reported including recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study analyzed variance among and between women, but did not report gaps, limitations, or uncertainties. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Blair, J. D., Ikonomou, M. G., Kelly, B. C., Surridge, B., Gobas, F. A. (2009). Ultra-trace determination of phthalate ester metabolites in seawater, sediments, and biota from an urbanized marine inlet by LC/ESI-MS/MS. Environmental Science & Technology 43(16):6262-6268. |
| **HERO ID:** | 787951 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methods, equipment, storage described for each sample type. |
| | Metric 2: | Analytical Methodology | High | Extraction details provided. Method detection limit provided. Instrumentation (GC-MS) and calibration described. Recovery tested. |
| | Metric 3: | Biomarker Selection | Medium | Metabolites measured seawater, sediments, and biota. It is unclear if these are direct metabolites of the parent chemicals of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | British Columbia |
| | Metric 5: | Currency | Medium | 2004-2006 |
| | Metric 6: | Spatial and Temporal Variability | High | n = 50. Sample duplicates taken. |
| | Metric 7: | Exposure Scenario | Medium | Seawater, marine sediments, invertebrates, and fish directly measured. No information provided on human exposure. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Range of data provided (Table 3), mean GM and SD provided (Figure 2). Individual points not reported. |
| | Metric 9: | Quality Assurance | High | Described in detail. Recovery, calibration, and method Validation described. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability in different sample mediums. RED reported. No limitations described. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Silva, M. J., Reidy, J. A., Samandar, E., Herbert, A. R., Needham, L. L., Calafat, A. M. (2005). Detection of phthalate metabolites in human saliva. Archives of Toxicology 79(11):647-652. |
| **HERO ID:** | 787994 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Some sampling methods not reported |
| | Metric 2: | Analytical Methodology | Medium | Recovery samples not reported |
| | Metric 3: | Biomarker Selection | Medium | Acceptable biomarkers |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | USA |
| | Metric 5: | Currency | Low | Sample data collected before 2005 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported |
| | Metric 9: | Quality Assurance | Low | Limited QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Hauser, R., Meeker, J. D., Park, S., Silva, M. J., Calafat, A. M. (2004). Temporal variability of urinary phthalate metabolite levels in men of reproductive age. Environmental Health Perspectives 112(17):1734-1740. |
| **HERO ID:** | 788014 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | recruitment previously described (Hauser et al. 2003). urine sampling described |
| | Metric 2: | Analytical Methodology | High | LOD provided in text, analytical approach developed at the CDC(Silva et al. 2003). |
| | Metric 3: | Biomarker Selection | High | metabolite |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | U.S. |
| | Metric 5: | Currency | Low | Timing of sample collection for monitoring data is not reported, discussed, or referenced. However, the publication year of 2004 is used as a proxy for sampling year. |
| | Metric 6: | Spatial and Temporal Variability | High | Table 1 n = 369, Table 3 n = 10 with 9 replicates |
| | Metric 7: | Exposure Scenario | High | human biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Table 3 raw data |
| | Metric 9: | Quality Assurance | High | One method blank, two quality control samples (human urine spiked with phthalates), and two sets of standards wereanalyzed along with every 21 unknown urine samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | temporal variability shown in Table 3 day 0 to 92 |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Lan, Q., Cui, K., Zeng, F., Zhu, F., Liu, H., Chen, H., Ma, Y., Wen, J., Luan, T., Sun, G., Zeng, Z. (2012). Characteristics and assessment of phthalate esters in urban dusts in Guangzhou city, China. Environmental Monitoring and Assessment 184(8):4921-4929. |
| **HERO ID:** | 788137 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most sampling information provided. Missing some pieces like sample equipment |
| | Metric 2: | Analytical Methodology | Low | Detailed extraction methods referenced to another study but LOD/LOQ not provided |
| | Metric 3: | Biomarker Selection | N/A | Measured parent chemicals in urban dust |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Guangzhou, China |
| | Metric 5: | Currency | Medium | Samples collected in 2007 |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicates collected |
| | Metric 7: | Exposure Scenario | Medium | Source of exposure not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported |
| | Metric 9: | Quality Assurance | Medium | QA/QC discussed. Recoveries not reported for all individual chemicals. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Some limitations reported |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Shi, W., Zhang, F. X., Hu, G. J., Hao, Y. Q., Zhang, X. W., Liu, H. L., Wei, S., Wang, X. R., Giesy, J. P., Yu, H. X. (2012). Thyroid hormone disrupting activities associated with phthalate esters in water sources from Yangtze River Delta. Environment International 42:117-123. |
| **HERO ID:** | 788233 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Detailed description of site locations, sample collection methods, storage, and filtration |
| | Metric 2: | Analytical Methodology | Medium | report general detection limit for pesticides/plasticizers but not specific chemicals; describe instrumentation but could be more detailed |
| | Metric 3: | Biomarker Selection | N/A | the study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Yangtze River Delta (China) |
| | Metric 5: | Currency | Medium | Mar-09 |
| | Metric 6: | Spatial and Temporal Variability | High | samples collected at 15 sites |
| | Metric 7: | Exposure Scenario | High | The Yangtze River Delta is a drinking water source for more than 20% of the area's population but there is contamination in the basin due to industrialization and inadequate water treatment |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | report concentrations in Table 4 but no error or range provided |
| | Metric 9: | Quality Assurance | High | included blanks and recoveries all >85% |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | discuss several limitations but little mention of variability/error |

## Overall Quality Determination High

**Study Citation:** Rudel, R. A., Gray, J. M., Engel, C. L., Rawsthorne, T. W., Dodson, R. E., Ackerman, J. M., Rizzo, J., Nudelman, J. L., Brody, J. G. (2011). Food packaging and bisphenol A and bis(2-ethyhexyl) phthalate exposure: Findings from a dietary intervention. Environmental Health Perspectives 119(7):914-920.

**HERO ID:** 788268

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | study participants recruitment described, urine sampling described, details in SI |
| | Metric 2: | Analytical Methodology | Medium | "Most limits of detection (LODs) were around 1 ng/mL." SI has detailed extraction, analysis and quantification methods |
| | Metric 3: | Biomarker Selection | High | metabolite |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | U.S. California |
| | Metric 5: | Currency | Medium | 2010 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 10 children and 10 adults, no replicates |
| | Metric 7: | Exposure Scenario | High | urine samples |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | min, median, max reported |
| | Metric 9: | Quality Assurance | High | Samples were analyzed in batches including quality control samples: a procedural blank, one spiked reference sample, and a reference sample in duplicate using laboratory stock urine for inter- and intrabatch comparisons. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Choi, H., Schmidbauer, N., Spengler, J., Bornehag, C. G. (2010). Sources of propylene glycol and glycol ethers in air at home. International Journal of Environmental Research and Public Health 7(12):4213-4237. |
| **HERO ID:** | 788298 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology is discussed, is scientifically sound and little to no inconsistencies were found. |
| | Metric 2: | Analytical Methodology | High | LOD included. Methodology was clear. Further detailson detection, calibration and quality assurance assessment are described in Online Supporting Documents. |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sweden. |
| | Metric 5: | Currency | Low | Timing of sample collection for monitoring data is not reported, discussed, or referenced. However, The publication year of 2010 is used as a proxy for sampling year. |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicates collected. |
| | Metric 7: | Exposure Scenario | High | The exposure scenarios discussed in the monitored study represents the exposure scenario of interest for the chemical. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data provided. |
| | Metric 9: | Quality Assurance | High | Quality assurance discussed. No red flags identified worthy of lower score. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | No gaps nor limitations reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Bergh, C., Torgrip, R., Emenius, G., Ostman, C. (2011). Organophosphate and phthalate esters in air and settled dust - a multi-location indoor study. Indoor Air 21(1):67-76. |
| **HERO ID:** | 788335 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The study discusses all elements of sampling methods. Sampling sites, and air and dust sampling collection are reported. |
| | Metric 2: | Analytical Methodology | Low | The analytical methodology is described, but the LOD or LOQ are not provided. |
| | Metric 3: | Biomarker Selection | N/A | The study tests the parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected at the Stockholm area in Sweden. |
| | Metric 5: | Currency | Low | Sampling date is not reported, the study was published in 2005. |
| | Metric 6: | Spatial and Temporal Variability | High | 10 samples were collected per environment. |
| | Metric 7: | Exposure Scenario | High | "Thirty sampling sites (in 10 private homes, 10 workplaces, and 10 daycare centers, all in the Stockholm area) were selected to represent a number of common indoor environments." |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Raw results and summary of data are reported in the supporting information. |
| | Metric 9: | Quality Assurance | Low | There is little discussion but can be implied via the use of standards. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability reported in terms of different scenarios. No discussion of uncertainty. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | He, H., Hu, G. J., Sun, C., Chen, S. L., Yang, M. N., Li, J., Zhao, Y., Wang, H. (2011). Trace analysis of persistent toxic substances in the main stream of Jiangsu section of the Yangtze River, China. Environmental Science and Pollution Research 18(4):638-648. |
| **HERO ID:** | 788371 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | 5 main sections, each with 3 sampling sites (left bank, channel line, and right bank); collected at 0.5m below surface; filled glass bottles to top; stored at 4C; extraction within 7 days; samples filtered |
| | Metric 2: | Analytical Methodology | Medium | SPE; GC/MS; MDL 10.0 ng/L and recoveries. MDL reported for group of chemical and not individual. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Jiangsu section of Yangtze River, China |
| | Metric 5: | Currency | Medium | September 2004 and January 2005 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 15 samples; 3 from each of the 5 main stream sections; sampled in September and then in December. Unclear if there are replicates. |
| | Metric 7: | Exposure Scenario | Medium | concentration in Jiangsu section (downstream of whole river) of Yangtze River which is the third longest river in the world; serves as important drinking water source; economically developed and densely populated; however automobile, textile, chemical, and electric production, shipping activity, and domestic sewage - all are not monitored and controlled |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Table 9 provides the range and mean per section of river; DBP detected in all sampling sites. Individual data not reported, little summary statistics provided. |
| | Metric 9: | Quality Assurance | Medium | No QA section- but recoveries 67.3-110.3% indicating methods were sufficient for this study; for every set of five samples, as blank was run to check for interference and cross-contamination |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | discusses variation between the five main sections; briefly compared results to previous study; compares concentrations in River to other water systems. No limitations reported. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Mackintosh, C. E., Maldonado, J., Hongwu, J., Hoover, N., Chong, A., Ikonomou, M. G., Gobas, F. A. (2004). Distribution of phthalate esters in a marine aquatic food web: Comparison to polychlorinated biphenyls. Environmental Science & Technology 38(7):2011-2020. |
| **HERO ID:** | 789501 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The marine species sampling methodology was described in detail and is scientifically sound. |
| | Metric 2: | Analytical Methodology | Medium | The analytical methods were described. Recoveries were not reported and the authors indicated that the LOD is in the SI. |
| | Metric 3: | Biomarker Selection | N/A | The authors analyzed marine species' samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Canada |
| | Metric 5: | Currency | Low | The samples were collected in 1999. |
| | Metric 6: | Spatial and Temporal Variability | Low | "9 individual samples of 18 marine species [...] Three samples of each species were collected from each of three sampling stations" |
| | Metric 7: | Exposure Scenario | Low | The data may represent a relevant exposure scenario related to phthalates in marine species in Canada, but the small sample size and missing details about the population of interest limit the results' generalization. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Limited summary statistics were reported. |
| | Metric 9: | Quality Assurance | Low | QA/QC details were included in the SI. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Limited characterization of variability (SD) and uncertainty. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Otake, T., Yoshinaga, J., Yanagisawa, Y. (2004). Exposure to phthalate esters from indoor environment. Journal of Exposure Science & Environmental Epidemiology 14(7):524-528. |
| **HERO ID:** | 789515 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology is only briefly described. The study cites another published work for a more complete description. |
| | Metric 2: | Analytical Methodology | Medium | Analytical methodology is only briefly discussed. Sampling precision and recovery was assessed. |
| | Metric 3: | Biomarker Selection | N/A | Concentrations were measured in indoor air. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in Tokyo, Japan. |
| | Metric 5: | Currency | Low | Sampling was performed in 2000. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Sampling was performed for 3 consecutive days from a total of 27 homes. The height of sampling from the floor was not specified. It is unclear how many samples per home were collected. Samples for 6 houses were collected in the spring, and samples for the remaining houses were collected in the fall. |
| | Metric 7: | Exposure Scenario | Medium | The stated study objective was to measure concentrations in contemporary Japanese houses. Only 27 houses or apartments were included, all in one city (Tokyo). All sampled homes belongs to staff affiliated with the researchers' university department. Chemical usage in the homes and characteristics of the homes were not really described. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics are reported, but missing information includes individual data points and the number of samples per home. Box plots were included, but symbols shown in the plots were not defined. |
| | Metric 9: | Quality Assurance | Medium | The study tested analytical precision and recovery. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Standard deviations were reported. Uncertainties, limitations, and data gaps were not really discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Vikelsøe, J., Thomsen, M., Carlsen, L. (2002). Phthalates and nonylphenols in profiles of differently dressed soils. Science of the Total Environment 296(1-3):105-116. |
| **HERO ID:** | 789658 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology is discussed in the data source and is generally appropriate (i.e., scientifically sound) for the chemical and media of interest, however, one or more pieces of sampling information is not described such as sample duration. The missing information is unlikely to have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | Low | The study discuss extension and improvement of the methods used in the previous study (Vikelsøe et al., 1998); no LOD discussed. |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in an environmental media (soil). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Roskilde, Denmark |
| | Metric 5: | Currency | Low | Timing of sample collection for monitoring data (1996, 1998) is not consistent with current exposures (>15 years old) that may be expected and likely to have a substantial impact on results. |
| | Metric 6: | Spatial and Temporal Variability | Medium | High samples for a single scenario (n = 20) however, no replicates used. |
| | Metric 7: | Exposure Scenario | Medium | Sludge amended soils. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Supplementary or raw data (i.e., individual data points) are not reported , and therefore summary statistics cannot be reproduced.Provided means only. |
| | Metric 9: | Quality Assurance | Medium | The study applied and documented quality assurance/quality control measures (blanks used, standards described); however, one or more pieces of QA/QC information is not described (storage recoveries). Missing information is unlikely to have a substantial impact on results. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and uncertainty is not discussed. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Suzuki, T., Yaguchi, K., Suzuki, S., Suga, T. (2001). Monitoring of phthalic acid monoesters in river water by solid-phase extraction and GC-MS determination. Environmental Science & Technology 35(18):3757-3763. |
| **HERO ID:** | 789731 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | river water samples collected every month from May to February at six sites (Fig 1); collected in 2L glass containers; samples filtered within 8 h |
| | Metric 2: | Analytical Methodology | High | SPE; GC/MS; MDLs provided in Table 4; recovery samples |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Tama River in Tokyo, Japan |
| | Metric 5: | Currency | Low | March 1999 to February 2000 |
| | Metric 6: | Spatial and Temporal Variability | High | six sites, collected every month from March to February; 12 times or 12 samples per site equaling 72 samples total |
| | Metric 7: | Exposure Scenario | High | concentration in water from Tama River which flows through Tokyo metropolitan area and empties into Tokyo Bay; densely populated area; effluent from sewage plants runs into river |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 4 provides detection times and range per site |
| | Metric 9: | Quality Assurance | Medium | recoveries measured but not reported for diesters; control samples |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | discusses major problem of controlling blank values (p.3760); discussed variation by study site |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Jang, Y. C., Townsend, T. G. (2001). Occurrence of organic pollutants in recovered soil fines from construction and demolition waste. Waste Management 21(8):703-715. |
| **HERO ID:** | 789748 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The authors mentioned using a standard sampling method, (US EPA SW-846 Chapter nine), the authors also report sampling equipment, procedures, storage conditions. |
| | Metric 2: | Analytical Methodology | High | Authors reported LODs, standard EPA methods were used for analysis and extraction. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Authors reference visiting and collecting samples from 14 construction and demolition sites in Florida. |
| | Metric 5: | Currency | Low | no sampling date is provided, but a publication date is available, 2000 so low anyways |
| | Metric 6: | Spatial and Temporal Variability | High | They collected duplicate samples, a total of >40 samples from different sample sites over a period of time to capture temporal trends. |
| | Metric 7: | Exposure Scenario | High | The authors described that samples were collected from construction and demolition sites, so they describe the setting. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data is not reported, only the ranges of concentrations, number of samples, detection frequencies, and there is no reporting of measure of variation. |
| | Metric 9: | Quality Assurance | Medium | Authors report collecting field blanks and analyzing lab blanks. The authors mentioned recoveries however it was related to the leaching experiments. There were no mentions of recoveries for extraction analysis. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No standard deviation is reported and there is no discussion on limitations or uncertainties. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Grigoriadou, A., Schwarzbauer, J., Georgakopoulos, A. (2008). Molecular indicators for pollution source identification in marine and terrestrial water of the industrial area of Kavala City, North Greece. Environmental Pollution 151(1):231-242. |
| **HERO ID:** | 792188 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The study has a clear and appropriate description of sampling methodology. |
| | Metric 2: | Analytical Methodology | High | The study provides detailed description of analytical method and instruments, and states detection limits. |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in an environmental media (surface water). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Kavala, Greece |
| | Metric 5: | Currency | Low | Timing of sample collection for monitoring data is not consistent with when current exposures (2003; >15 years old) may be expected and likely to have a substantial impact on results. |
| | Metric 6: | Spatial and Temporal Variability | High | Eight terrestrial and four marine water samples. |
| | Metric 7: | Exposure Scenario | High | Water samples collected from industrial section of Kavala to determine the occurrence of anthropogenic contaminants. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | The study provides concentrations at each site but summary stats and measure of variation is not provided. |
| | Metric 9: | Quality Assurance | Low | There was no thorough implementation of quality controls. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | There is no discussion of variability, limitations, or uncertainty. |
| **Overall Quality Determination** | | | **Medium** | |

**Study Citation:** Teitelbaum, S. L., Britton, J. A., Calafat, A. M., Ye, X., Silva, M. J., Reidy, J. A., Galvez, M. P., Brenner, B. L., Wolff, M. S. (2008). Temporal variability in urinary concentrations of phthalate metabolites, phytoestrogens and phenols among minority children in the United States. Environmental Research 106(2):257-269.

**HERO ID:** 792230

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | epi enrollment and sampling described. Study was approved by the Institutional Review Boards of Mount Sinai School of Medicine and the CDC. No description of sample collection equipment. |
| | Metric 2: | Analytical Methodology | High | LOD in table 1. Samples were analyzed at the National Center for Environmental Health of the Centers for Disease Control and Prevention (CDC). CDC laboratory is certified by the Health Care Financing Administration |
| | Metric 3: | Biomarker Selection | High | metabolite |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | U.S. NYC |
| | Metric 5: | Currency | Low | 2004 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 24, no replicates |
| | Metric 7: | Exposure Scenario | High | urine, human biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | tertiles provided |
| | Metric 9: | Quality Assurance | Medium | all analytical methods, standard quality control (QC) and reagent blank samples were included in each analytical batch along with the unknown samples. No QC to ensure phthalate contamination during sample collection. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | temporal variability discussed |

## Overall Quality Determination Medium

**Study Citation:** Sánchez-Avila, J., Fernandez-Sanjuan, M., Vicente, J., Lacorte, S. (2011). Development of a multi-residue method for the determination of organic micropollutants in water, sediment and mussels using gas chromatography-tandem mass spectrometry. Journal of Chromatography A 1218(38):6799-6811.

**HERO ID:** 807137

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Critically Deficient | No sampling information is included other than media type. |
| | Metric 2: | Analytical Methodology | High | This is a method development paper, so the method is well described. |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in an environmental media (water/sediment/mussels). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | Critically Deficient | No sampling location is provided. |
| | Metric 5: | Currency | Low | Timing of sample collection for monitoring data is not reported, discussed, or referenced but the publication year is 2011. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Sampling approach likely captures variability of environmental contamination in population/scenario/media of interest. However, the study used a moderate sample size (n = 5). |
| | Metric 7: | Exposure Scenario | Medium | The data likely represent the relevant exposure scenario (seawater, river water, WWTP effluent, sediments, and mussels). One or more key pieces of information may not be described (sampling locations, climate info) but the deficiencies are unlikely to have a substantial impact on the characterization of the exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Average, minimum, maximum, and number of detections reported. |
| | Metric 9: | Quality Assurance | Medium | Quality parameters for method reported in Table 2. However there is no discussion of field protocols (sample collection/storage), mainly because this is is a method development paper. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability and uncertainty not described, no obvious concerns. |

## Overall Quality Determination — Uninformative

| | |
|---|---|
| **Study Citation:** | Mo, C. H., Cai, Q. Y., Li, Y. H., Zeng, Q. Y. (2008). Occurrence of priority organic pollutants in the fertilizers, China. Journal of Hazardous Materials 152(3):1208-1213. |
| **HERO ID:** | 1003896 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | The sampling procedures were not reported. The study only mentioned they collected 22 samples from widely-used fertilizers in China from different factories/companies. It is unclear how they chose those fertilizers or how they selected the factories to obtain the samples. Storage conditions and storage duration time was not reported but they referenced another paper in describing precautions taken during sampling. |
| | Metric 2: | Analytical Methodology | Medium | LODs and recoveries were reported by authors. They used a modified standard EPA method for extraction and analysis. Authors did not report any instrument calibration. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent compounds in fertilizers. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Authors collected samples from China |
| | Metric 5: | Currency | Low | No sampling data reported, but the publication date is 2007. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Study reports collecting 22 different fertilizers across China. I am assuming this is 22 different samples. No replicates were reportedly collected. Timing on data collection was not reported so it is unclear the temporal nature of the study. |
| | Metric 7: | Exposure Scenario | Medium | Study measured concentration of key chemicals in a consumer product, fertilizer. The actual scenario of use was not described, the authors looked at chemical concentration in the product. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data reported, but missing some summary statistics. |
| | Metric 9: | Quality Assurance | Low | The authors reported, "The detailed quantification method, the details of the quality assurance/quality control(QA/QC) have been presented elsewhere," but they did not mention collecting and analyzing control samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No characterization of variance and little discussion about gaps, uncertainties, and limitations. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Langer, S., Weschler, C. J., Fischer, A., Bekö, G., Toftum, J., Clausen, G. (2010). Phthalate and PAH concentrations in dust collected from Danish homes and daycare centers. Atmospheric Environment 44(19):2294-2301. |
| **HERO ID:** | 1007791 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling procedure, equipment, matrix characters are clearly described and detailed description was provided in the supplementary materials. |
| | Metric 2: | Analytical Methodology | High | GC/MS was used to analyze the dust samples and recoveries were reported. LOQs were reported in Table S1. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Odense, Denmark |
| | Metric 5: | Currency | Medium | The dust samples were collected in 2008. |
| | Metric 6: | Spatial and Temporal Variability | High | The study has large sample size and can capture the variability of environmental contamination in population and scenario. |
| | Metric 7: | Exposure Scenario | Medium | The data likely represent the relevant exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Supplementary or raw data or individual data points are not reported. |
| | Metric 9: | Quality Assurance | High | Quality assurance was conducted. Recoveries for samples were reported and all above 90%. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | The study has a robust comparison to other publications and discussion of limitations. It provides evidence for the consistency of the data. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Wang, G., Kawamura, K., Lee, S., Ho, K., Cao, J. (2006). Molecular, seasonal, and spatial distributions of organic aerosols from fourteen Chinese cities. Environmental Science & Technology 40(15):4619-4625. |
| **HERO ID:** | 1229018 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology is scientifically sound and comprehensive. Site, equipment, storage, and methods described. Missing instrument calibration. |
| | Metric 2: | Analytical Methodology | Low | LOQ, LOD not reported. Extraction methods and analytical instrument described (GC-MS). Missing instrument calibration. Recovery samples reported. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental sample. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China. |
| | Metric 5: | Currency | Low | Samples from 2003 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Two 24 h samples in each city (14) in two seasons. 56 samples in total. No replicates. |
| | Metric 7: | Exposure Scenario | Medium | Likely to represent exposure scenario but there isn't sufficient description about population that would be exposed. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data points are provided in SI. Average concentrations reported but little summary statistics. |
| | Metric 9: | Quality Assurance | Medium | QA/QC was conducted but lacks thorough description. Average recoveries of all the standards were better than 80%. Collected field blanks. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variation in cities and seasons analyzed. SD reported in article and S1. No discussion of uncertainties, limitations or data gaps. |

## Overall Quality Determination Medium

**Study Citation:** Schlumpf, M., Kypke, K., Wittassek, M., Angerer, J., Mascher, H., Mascher, D., Vökt, C., Birchler, M., Lichtensteiger, W. (2010). Exposure patterns of UV filters, fragrances, parabens, phthalates, organochlor pesticides, PBDEs, and PCBs in human milk: correlation of UV filters with use of cosmetics. Chemosphere 81(10):1171-1183.

**HERO ID:** 1249442

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology discussed extensively in terms of sampling equipment, procedures, storage, and study site (participants' homes). Insufficient information on duration of sample storage time prior to sample analysis. |
| | Metric 2: | Analytical Methodology | Medium | Extraction methodology, analytical instrumentation (phthalates: LC/LC-MS/MS), and LOD only as a range for phthalates. Analytic methods noted as following modified referenced procedures. Insufficient information on instrument calibration, recovery rates for chemicals of interest. |
| | Metric 3: | Biomarker Selection | High | Sampling for metabolite of chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Switzerland |
| | Metric 5: | Currency | Medium | Phthalates sampling in 2006. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Daily breast milk samples pooled and analyzed for n=20 samples for DEHP, BBP, DBP, and DIBP, n=6 DINP samples, however non-statistical sampling approach. |
| | Metric 7: | Exposure Scenario | Medium | Breast milk samples from women with insufficient information on profession/occupation (although present and past profession data collected within survey, authors noted it as not sufficiently detailed for use within analysis). Lack of field blank/exposure controls. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Breast milk sample lipid-adjusted concentration summary statistics reported as means with SD, median, 95th percentile, and range for year of sampling with number of samples analyzed and number of positive detected samples. Location of sampling described as at home of participant. Insufficient information on raw data sampling results. |
| | Metric 9: | Quality Assurance | Medium | Quality assurance measures in sampling procedures described in terms of trained personnel assistance in breast milk sampling, training of mothers in procedures and adherence to procedures insuring lack of sample contamination. Insufficient information on correction for blank concentrations, lack of baseline/pre-exposure sampling. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Sampling variability characterized and ranges of exposures for each chemical presented. Authors note most reported concentrations similar compared to previous European publications, however discussion of study limitations/uncertainties lacking. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Bergh, C., Aberg, K. M., Svartengren, M., Emenius, G., Oestman, C. (2011). Organophosphate and phthalate esters in indoor air: a comparison between multi-storey buildings with high and low prevalence of sick building symptoms. Journal of Environmental Monitoring 13(7 (Jul 2011)):2001-2009. |
| **HERO ID:** | 1249459 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology for indoor air was sound and sufficiently detailed. Duration of sample storage was not detailed. |
| | Metric 2: | Analytical Methodology | High | Analytical methodology was sound and sufficiently detailed. Method detection limits were reported within Table 2. |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | This study collected indoor air samples within multistory buildings in Stockholm, Sweden participating in the Healthy Sustainable Houses study in Stockholm (3H). |
| | Metric 5: | Currency | Low | Sample collection dates were not provided, however study publication date was 2011. |
| | Metric 6: | Spatial and Temporal Variability | High | Duplicate 24-hour active air samples were collected from two to four apartments (a total of 169 apartments) in each of 45 multistory buildings. |
| | Metric 7: | Exposure Scenario | High | The exposure scenario was well characterized within this study of indoor air within apartments of multistory buildings. Identification of the potential sources of indoor air contaminants was one of the study's main objectives, and a robust discussion of potential sources was presented. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data and detection frequency was not presented. Summary statistics were presented and included mean, median and minimum and maximum concentration levels. |
| | Metric 9: | Quality Assurance | Medium | Quality assurance (QA) methods, such as replicate sampling and use of field blanks, were reported and although QA details were not reported in detail, standard procedures were followed. Authors referenced another study for additional sampling and analytic details (C. Bergh, R. Torgrip and C. € Ostman, Rapid Commun. MassSpectrom., 2010, 24, 2859–2867). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability was described in sampling summary statistics. Median concentration levels were compared with results from previous studies within tables, however a robust discussion of potential study limitations is lacking. |
| **Overall Quality Determination** | | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | Salapasidou, M., Samara, C., Voutsa, D. (2011). Endocrine disrupting compounds in the atmosphere of the urban area of Thessaloniki, Greece. Atmospheric Environment 45(22):3720-3729. |
| **HERO ID:** | 1249468 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling equipment and methods are described in sufficient detail and are scientifically sound. |
| | Metric 2: | Analytical Methodology | Low | Analytical instrumentation and methods are described in sufficient detail and are scientifically sound. However, neither LOD nor LOQ is reported. |
| | Metric 3: | Biomarker Selection | N/A | This study is testing for the parent chemical of interest in an environmental medium. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Greece |
| | Metric 5: | Currency | Medium | 2007 |
| | Metric 6: | Spatial and Temporal Variability | High | 24-hour air samples from two sites (10 at each site) |
| | Metric 7: | Exposure Scenario | High | Each air sampling site was characterized as either urban-traffic or urban-industrial. Pertinent meteorological data were also incorporated into analysis. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data are not reported; summary statistics include frequency of detection, mean, standard deviation, median, minimum, and maximum concentration at each site. |
| | Metric 9: | Quality Assurance | High | Authors followed criteria concerning the performance of analytical methods as reported in Commission Decision 2002/657/EC as well as quantification by internal standard. Matrix spiked recoveries were within acceptable ranges. For phthalates, blank values were high but consistent, and mean blank values were subtracted from sample results. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Standard deviation is reported and indicates high variability at each sampling site. There is some discussion of limitations or sources of uncertainty in the methodology. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Björklund, K., Strömvall, A. M., Malmqvist, P. A. (2011). Screening of organic contaminants in urban snow. Water Science and Technology 64(1):206-213. |
| **HERO ID:** | 1249477 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Collected roadside snow few days after snowfall at 3 sites (Karra, Garda, Jarnbrott) and sample snow 3 deposits (Gardamotet, Heden, Valhamra) at end of winter (Table 1); urban background sample collected in Delsjon forest area; collected in glass containers or stainless-steel containers; thawed at room temperature before extraction. |
| | Metric 2: | Analytical Methodology | Low | LL extracted with n-hexane; GC-MS; DL 0.1-2.0 ug/L; recoveries not mentioned. LOD not reported. |
| | Metric 3: | Biomarker Selection | N/A | Parent compound in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Gothenburg, Sweden. |
| | Metric 5: | Currency | Medium | 2009 and 2010. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 11 samples; samples 2/5/2009 and 1/26, 3/5, 3/30 2010 (Table 1); not clear if replicate samples were taken at same time. |
| | Metric 7: | Exposure Scenario | High | Contamination in urban snow. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Fig 2d shows concentration by sampling site and date; DF, ranges, max provided in text p.211- hard to see values. Individual data not reported, little summary statistics. |
| | Metric 9: | Quality Assurance | Medium | No individual QC section. No recoveries mentioned; procedural blanks used. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Discussed variability between sites and time; compared results to other studies. Some limitations discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Braun, J. M., Smith, K. W., Williams, P. L., Calafat, A. M., Berry, K., Ehrlich, S., Hauser, R. (2012). Variability of urinary phthalate metabolite and bisphenol A concentrations before and during pregnancy. Environmental Health Perspectives 120(5):739-745. |
| **HERO ID:** | 1249501 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | IRB approval by Harvard and CDC |
| | Metric 2: | Analytical Methodology | Medium | LOD range provided; previously described methods (Silva et al. 2007; Ye et al. 2008) |
| | Metric 3: | Biomarker Selection | High | metabolites |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | U.S. |
| | Metric 5: | Currency | Medium | 2004-2009 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 137 women, no replicates |
| | Metric 7: | Exposure Scenario | High | urine |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | GM, median, 25th and 75th percentile |
| | Metric 9: | Quality Assurance | Medium | previously described quality procedures (Silva et al. 2007; Ye et al. 2008) |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | variability analyses conducted |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Sexton, K.,en, Ryan, A. D. (2012). Using exposure biomarkers in children to compare between-child and within-child variance and calculate correlations among siblings for multiple environmental chemicals. Journal of Exposure Science & Environmental Epidemiology 22(1 (Jan 2012)):16-23. |
| **HERO ID:** | 1249704 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling in briefly described |
| | Metric 2: | Analytical Methodology | High | Analytical methods for each category of chemical biomarkerand the limit of detection for each chemical are described inthe CDC's Third National Report on Human Exposure toEnvironmental Chemicals (CDC, 2005). |
| | Metric 3: | Biomarker Selection | High | Mono-benzyl phthalate |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | USA Minneapolis |
| | Metric 5: | Currency | Low | 2000-2001 |
| | Metric 6: | Spatial and Temporal Variability | High | Within child analysis. 83 participants |
| | Metric 7: | Exposure Scenario | High | Children exposed to phthalates |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No individual data reported. Table 2. en-child and within-child variance of biomarkers in blood among SHIELD index children. |
| | Metric 9: | Quality Assurance | Critically Deficient | The study doesn't report any QA/QC criteria |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study doesn't report key limitations. Data presented as between-child and within child variance |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Krotz, S. P., Carson, S. A., Tomey, C., Buster, J. E. (2012). Phthalates and bisphenol do not accumulate in human follicular fluid. Journal of Assisted Reproduction and Genetics 29(8):773-777. |
| **HERO ID:** | 1249856 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | IRB approval |
| | Metric 2: | Analytical Methodology | Low | AXYS method MLA-059 - previously described; equipment described; no LOD |
| | Metric 3: | Biomarker Selection | Critically Deficient | metabolites |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | U.S. |
| | Metric 5: | Currency | Medium | 2008 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 5, no replicates |
| | Metric 7: | Exposure Scenario | High | human follicular fluid |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | raw data, mean and SD in Table 1 |
| | Metric 9: | Quality Assurance | Low | QA not described, no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not described, no obvious concerns |

## Overall Quality Determination — Uninformative

| | |
|---|---|
| **Study Citation:** | Sexton, K., Ryan, A. D., Adgate, J. L., Barr, D. B., Needham, L. L. (2011). Biomarker measurements of concurrent exposure to multiple environmental chemicals and chemical classes in children. Journal of Toxicology and Environmental Health, Part A: Current Issues 74(14):927-942. |
| **HERO ID:** | 1249965 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Whole blood samples and urine samples were refrigerated and shipped weekly (packed in freezer packs) to the NationalCenter for Environmental Health, Centers for Disease Control and Prevention, in Atlanta. Some information missing such as equipment used to collect blood and urine samples. |
| | Metric 2: | Analytical Methodology | Medium | Analytical method and equipment described (liquid chromatography–atmospheric pressure chemical ionization inconjunction with tandem MS), LOD not directly reported, but % of samples <LOD reported in table 1. Calibration missing. |
| | Metric 3: | Biomarker Selection | High | Metabolite derived from parent chemical (Monobenzyl phthalate (MBzP)). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Minneapolis, USA |
| | Metric 5: | Currency | Low | 2000-2001 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 152 children. There were children with more than one measurement but it is unclear which ones. Timing of urine samples collected not reported. |
| | Metric 7: | Exposure Scenario | High | Children from disadvantaged, low-income neighborhoods are likelyto be both more exposed to chemical hazards and more susceptible to related adverse health effects. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data. TABLE 1 has Summary of Cotinine (ng/ml), Chromium ($\mu$g/ml), Mercury ($\mu$g/ml), and Phthalate (ng/ml) Concentrations in Urine Samples From SHIELD Children. Arithmetic mean (SD), P95, and max reported. |
| | Metric 9: | Quality Assurance | Low | No QA/QC reported, but samples were analyzed at the NationalCenter for Environmental Health, Centers for Disease Control and Prevention. No recoveries or blanks reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Key limitations not reported. Variability (geometric mean) reported in summary of statistics (Table 1). Comparison with CDC data. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Shi, W., Hu, X., Zhang, F., Hu, G., Hao, Y., Zhang, X., Liu, H., Wei, S., Wang, X., Giesy, J. P., Yu, H. (2012). Occurrence of thyroid hormone activities in drinking water from eastern China: Contributions of phthalate esters. Environmental Science & Technology 46(3):1811-1818. |
| **HERO ID:** | 1249969 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Describe sampling sites, equipment, preparation, storage. |
| | Metric 2: | Analytical Methodology | High | Describe analytical instrumentation extraction method; report limit of quantification; recoveries all > 90%. |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in an environmental media (water). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Yangtze River Delta in eastern China. |
| | Metric 5: | Currency | Medium | 2010 |
| | Metric 6: | Spatial and Temporal Variability | High | 5 sampling sites, 3 types of water sources at each site, n = 3 per sample type (so 45 samples total). |
| | Metric 7: | Exposure Scenario | Medium | Measuring phthalate esters in water sources. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data for individual samples but thorough summary of concentrations; provides averages and standard deviations. |
| | Metric 9: | Quality Assurance | Medium | Used blanks and standards. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Provide standard deviations and measures of variability but no discussion of limitations/uncertainty. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Teitelbaum, S. L., Mervish, N., Moshier, E. L., Vangeepuram, N., Galvez, M. P., Calafat, A. M., Silva, M. J., Brenner, B. L., Wolff, M. S. (2012). Associations between phthalate metabolite urinary concentrations and body size measures in New York City children. Environmental Research 112:186-193. |
| **HERO ID:** | 1249979 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | IRB from Mount Sinai School of Medicine and CDC. |
| | Metric 2: | Analytical Methodology | Low | CDC laboratory is certified by the Health Care Financing Administration. LOD not provided. |
| | Metric 3: | Biomarker Selection | High | metabolites |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | U.S. |
| | Metric 5: | Currency | Medium | 2004-2007 |
| | Metric 6: | Spatial and Temporal Variability | Medium | girls n=299; boys n=80, no replicates |
| | Metric 7: | Exposure Scenario | High | urine |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | median provided |
| | Metric 9: | Quality Assurance | Medium | Quality control samples were evaluated according to standard statistical probability rules (www.westgard.com). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Marttinen, S. K., Kettunen, R. H., Rintala, J. A. (2003). Occurrence and removal of organic pollutants in sewages and landfill leachates. Science of the Total Environment 301(1-3):12-Jan. |
| **HERO ID:** | 1249997 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported in detail |
| | Metric 2: | Analytical Methodology | Medium | Recovery samples not reported. LOQ reported in text on pg 4 as 1ug/L for phthalates. |
| | Metric 3: | Biomarker Selection | N/A | Measured parent chemicals in stormwater and landfill leachate |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Finland |
| | Metric 5: | Currency | Low | Studies conducted between 1998 and 2001 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | High | Phthalates levels measured in the effluent of sewage treatment plants, sludges, and landfill leachates |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | raw data reported in the manuscript but missing most summary statistics |
| | Metric 9: | Quality Assurance | Low | Limited QA/QC reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Few gaps and limitations reported and limited characterization of variance |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Zhang, L., Dong, L., Ren, L., Shi, S., Zhou, L., Zhang, T., Huang, Y. (2012). Concentration and source identification of polycyclic aromatic hydrocarbons and phthalic acid esters in the surface water of the Yangtze River Delta, China. Journal of Environmental Sciences 24(2):335-342. |
| **HERO ID:** | 1250079 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | surface water collected in June 2010 from 14 sites in urbanized Yangtze River Delta region; from top layer (0-40 cm) using stainless steel barrel; collected in brown glass containers; transported and processed immediately |
| | Metric 2: | Analytical Methodology | High | liquid-liquid extraction with methylene chloride; GC/MS; MDL around 2.0 ng/L for the six PAEs; recovery samples |
| | Metric 3: | Biomarker Selection | N/A | Surface water sampling |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Yangtze River Delta, China |
| | Metric 5: | Currency | Medium | Jun-10 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 14 samples (Fig 1 and Table 1) from 8 sites in Suzhou City, 3 sites in Wuxi City, an 3 in Nantong City; no replicate samples discussed; sampled in a single month |
| | Metric 7: | Exposure Scenario | High | surface water of rapidly urbanized and economic development Yangtze River Delta region |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Table 2 provides concentration at the different sampling sites (raw data); DF at the 14 sample locations provided in text (p. 338) |
| | Metric 9: | Quality Assurance | High | recoveries varied from 86.3-93.7 for water samples (p. 337); field blanks and spiked blanks used; concentrations corrected by field blanks data but not further corrected by surrogate recovery data |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | compared concentrations by the different sampling locations and to previous studies and locations (Table 3) |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Deleon, I. R., Byrne, C. J., Peuler, E. A., Antoine, S. R., Schaeffer, J., Murphy, R. C. (1986). Trace organic and heavy metal pollutants in the Mississippi River USA. Chemosphere 15(6):795-805. |
| **HERO ID:** | 1267509 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling method was described in details, including equipment, storage, and study site characteristics. |
| | Metric 2: | Analytical Methodology | Low | GC/MS was used for the analysis. LOQ or reporting limits were not reported. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Mississippi River |
| | Metric 5: | Currency | Low | Sampling took place in summer of 1984. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Sampling took place at 11 stations along the Mississippi River. Only few samples had replicates. |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant exposure scenario (surface water). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Individual data were provided in the main article but a lot of summary statistics are missing. |
| | Metric 9: | Quality Assurance | Low | Quality assurance was not directly discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study has limited discussion of key uncertainties, limitations, and data gaps. There is variation in the sites sampled along the river. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Wilkie, P. J., Hatzimihalis, G., Koutoufides, P., Connor, M. A. (1996). The contribution of domestic sources to levels of key organic and inorganic pollutants in sewage: The case of Melbourne, Australia. Water Science and Technology 34(3-4):63-70. |
| **HERO ID:** | 1268223 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | NATA approved sampling protocols; discussed by run in Sampling Program (p. 67-68); equipment not defined |
| | Metric 2: | Analytical Methodology | Low | NATA approved analytical procedures; no other discussion on analytical methodology; LOD/LO not provided |
| | Metric 3: | Biomarker Selection | N/A | Measured parent compounds in sewage |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Melbourne, Australia |
| | Metric 5: | Currency | Low | 1994 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 8 sites; 7 separate sampling runs (March, June, Aug, Aug, Nov, Nov, December - 1994); 60 samples total. Duplicates collected for some sites but on different runs. |
| | Metric 7: | Exposure Scenario | High | concentrations in sewage from range of residential areas |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 3 provides concentration mean, range, std, and outliers in domestic sewage as well as mean conc in domestic water supply and mean in treated plant influents. No raw data. |
| | Metric 9: | Quality Assurance | Low | QA/QC not discussed but implied by use of standard protocols |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | briefly discusses variability between results, comparison with other cities, and time-related trends. Little characterization of limitations, gaps, and uncertainties |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | PFAUDLER CO, (1985). Comments to reports of groundwater contamination at Pfaudler plant site with attached hydrogeologic report. |
| **HERO ID:** | 1269532 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The sampling methodology is described in the field investigation section |
| | Metric 2: | Analytical Methodology | Medium | LOD is not reported, analytical methodology described in table 3 |
| | Metric 3: | Biomarker Selection | N/A | BBP in groundwater |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Wheatfield, N.Y. |
| | Metric 5: | Currency | Low | 1984 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 10 samples , sample triplicates |
| | Metric 7: | Exposure Scenario | High | Ground water contamination from a graphite plant |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 3, VI and XI presents summary of data, but there is not report on the statistics analysis |
| | Metric 9: | Quality Assurance | High | QA parameter presented in table XI |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No information on variability or key limitations |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Burgess & Niple, (1981). Chemical and biological sampling program on Scippo Creek. 870002032:#86-870002032. |
| **HERO ID:** | 1269709 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | The sampling procedure was generally described, lacking important information. |
| | Metric 2: | Analytical Methodology | Medium | GC/MS was used for analysis. LOQ was reported to be less than 0.01 ug/L. No information on other parameters like extraction method. |
| | Metric 3: | Biomarker Selection | N/A | Measured parent chemicals in creek |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Scippo Creek, Ohio |
| | Metric 5: | Currency | Low | Sampling took place in July 1980. |
| | Metric 6: | Spatial and Temporal Variability | Low | Sampling size was not clearly provided, but at least 3 stations were reported in the study. |
| | Metric 7: | Exposure Scenario | High | The data represents a relevant exposure scenario with the chemicals' possible harm to aquatic life. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data for the stations reported were available for some of the stations, but lacked standard deviation and a few other important summary statistics. |
| | Metric 9: | Quality Assurance | Low | No quality assurance measure was directly provided, but can be implied based on the study. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | The study has limited discussion of key uncertainties, limitations, and data gap. No characterization of variance |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | SUNY, (2009). Concentration of phthalate in dorm rooms and its association with asthma and allergy. 2:1012-1020. |
| **HERO ID:** | 1312101 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling methodology briefly described and appropriate, missing information on blanks, and cross contamination care during sample |
| | Metric 2: | Analytical Methodology | Low | very limited description, no limits of detection, QC, blanks, recoveries |
| | Metric 3: | Biomarker Selection | N/A | Dust samples, biomarker not needed. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | 2007 |
| | Metric 6: | Spatial and Temporal Variability | High | 175 dust samples |
| | Metric 7: | Exposure Scenario | High | College dorms |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Some stats in Figure 1 and Table 2 median |
| | Metric 9: | Quality Assurance | Low | Analytical not described or reported, did have sampling controls, but unknown how these were collected and assessed |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | some discussion on the variability, but without the QC and details of sampling is tough to know if discussion is correct |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Wallner, P., Kundi, M., Moshammer, H., Piegler, K., Hohenblum, P., Scharf, S., Fröhlich, M., Damberger, B., Tapplere, P., Hutter, H. P. (2012). Indoor air in schools and lung function of Austrian school children. Journal of Environmental Monitoring 14(7):1976-1982. |
| **HERO ID:** | 1313395 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methods for 252 chemical indoor parameters within 26 substance groups, including formaldehyde (FDH) and tris (2-chloroethyl) phosphate (TCEP) in air, and butyl benzyl phthalate (BBP) in dust were detailed. There was no mention of sample storage or sampler calibration. |
| | Metric 2: | Analytical Methodology | Low | Analytical methods were briefly described, however there was no mention of sample recoveries or instrument calibration and although the number of samples greater than the LOQ was presented in Table 2, the actual LOQ or LOD was not reported for each chemical sampled. |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Austrian elementary schools. |
| | Metric 5: | Currency | Low | Timing of sample collection for monitoring data is not reported, discussed, or referenced. However, the study was published in 2012. |
| | Metric 6: | Spatial and Temporal Variability | Medium | The study reported results of samples >LOQ for n=35 air samples and n=36 dust samples for the chemicals of interest. Replicate sampling was conducted as two samples were simultaneously obtained per classroom for one day in two seasons (autumn and spring). Continuous 24-hour active air sampling was conducted. Dust sampling was conducted once a day for one week using vacuum cleaners, with no replicate sampling detailed. |
| | Metric 7: | Exposure Scenario | High | The exposure scenario was well characterized as the indoor air and dust measurements were obtained from first and second year classrooms in nine elementary schools from Austrian urban and rural regions as part of the Children's Environment and Health Action Plan for Europe (CEHAPE) of WHO and the LUKI project. Exposure sources were briefly detailed. Microclimate information regarding temperature and humidity were measured but not reported or included in models with lung function outcomes. Use of exposure controls was not detailed. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data was not reported. Statistical summary measures included median, minimum, and maximum concentrations. Frequency of detection was reported as number of samples >LOQ. Sampling dates were not reported. |
| | Metric 9: | Quality Assurance | Low | There was no discussion of QA/QC methods or results within the main text, however it can be inferred that proper protocols were followed through the study's use of standard sampling and analytic methods. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The non-random school selection process may have introduced bias in indoor air quality assessment, however of the 19 schools interested in participating, the nine schools selected were representative of a variety of community sizes and types. Potential study limitations were discussed in detail. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Blanchard, M., Teil, M. J., Dargnat, C., Alliot, F., Chevreuil, M. (2013). Assessment of adult human exposure to phthalate esters in the urban centre of Paris (France). Bulletin of Environmental Contamination and Toxicology 90(1):91-96. |
| **HERO ID:** | 1315297 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most details provided- the study reported to use reference 506 to 606 (US EPA) as the guidance methods to perform the sampling. The food intake calculation was not provided, however. |
| | Metric 2: | Analytical Methodology | High | HRGC was used for the analysis, detection limits were reported for each chemical. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Urban district in Paris, France |
| | Metric 5: | Currency | Medium | 2006-2008 |
| | Metric 6: | Spatial and Temporal Variability | Medium | tap water (n = 3) and bottled water (plain springwater n = 3, plain mineral water n = 8 and sparklingmineral water n = 4), food (4 items in lunch tray over 4 days), air (6 sampling period of 10 days). Unclear if replicates. |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant exposure scenario (i.e., the urban environment). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Mean concentrations were provided but lacked summary statistics. Individual data were not provided. |
| | Metric 9: | Quality Assurance | Medium | No discussed directly- Recoveries were reported to be used, and recovery rates were all above 75% for the chemicals of interest. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study compared its results to other publications and standards in other countries and had robust discussion of the variability. No limitations reported. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Carlstedt, F., Jönsson, B. A., Bornehag, C. G. (2013). PVC flooring is related to human uptake of phthalates in infants. Indoor Air 23(1):32-39. |
| **HERO ID:** | 1315309 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling population described, methodology described but handling of sampling material not well described |
| | Metric 2: | Analytical Methodology | Medium | Recoveries not reported |
| | Metric 3: | Biomarker Selection | High | Biomarker derived from exposure |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Varmland, Sweden |
| | Metric 5: | Currency | Medium | Study published in 2013 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | High | Exposure source characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not provided |
| | Metric 9: | Quality Assurance | Medium | QA implied but not well reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Gaps and limitations not well characterized |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | De Vault, D. S. (1985). Contaminants in fish from great lakes harbors and tributary mouths. Archives of Environmental Contamination and Toxicology 14(5):587-594. |
| **HERO ID:** | 1315838 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | sampling described in detail |
| | Metric 2: | Analytical Methodology | Low | GC method described. detection limit for compound of interest not reported |
| | Metric 3: | Biomarker Selection | N/A | parent chemical in environmental media |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | harbor and tributary mouth sites in the Great Lakes basin |
| | Metric 5: | Currency | Low | 1980/1981 |
| | Metric 6: | Spatial and Temporal Variability | Medium | between 1-15 samples per fish in the different river locations |
| | Metric 7: | Exposure Scenario | Medium | pesticides in runoff into the waters of the Great Lakes Harbours and Tributaries |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | individual sample concentrations and raw data reported |
| | Metric 9: | Quality Assurance | Low | QA/QC not discussed but implied |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | variability shown in samples but not explicitly identified or discussed |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Mcfall, J. A., Antoine, S. R., Deleon, I. R. (1985). Organics in the water column of Lake Pontchartrain. Chemosphere 14(9):1253-1266. |
| **HERO ID:** | 1315842 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | 8 replicate water samples collected at depth of 1.5 m on ebb tide on May 6 and 2 samples collected at depth of 1.5 m and 10m on flood tide on June 23 at Inner Harbor Navigation Canal; collected with a drop sampler; stored in amber glass bottles; immediately chilled and kept at 4C |
| | Metric 2: | Analytical Methodology | Low | serially extracted with 125 x 50 x 50 ml portions of dichloromethane; GC-MS; detection limits not provided; no recovery samples |
| | Metric 3: | Biomarker Selection | N/A | Measured parent chemicals in water column |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Inner Harbor Navigation Canal of Lake Pontchartrain, New Orleans, LA |
| | Metric 5: | Currency | Low | 1980 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 8 replicate samples collected at depth of 1.5 m on ebb tide on May 6 and 2 samples at depths of 1.5 m and 10 m on flood tide on June 23. Scoring for metric based on # samples from ebb tide |
| | Metric 7: | Exposure Scenario | High | surface water levels of Lake Pontchartain which serves an adjacent metropolitan area as a major recreational area and source of crabs, shrimp and other aquatic foods |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Table 1 provides concentration of ebb and flood tide; ebb is mean of 8 samples (no raw data); flood is concentration of a single sample. Missing most summary statistics. |
| | Metric 9: | Quality Assurance | Low | QA/QC not directly discussed |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | brief comparison of results between ebb and flood tides and differences in two different depths. No characterization of variance or discussion of limitations, uncertainties, and data gaps. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Atwater, J. W., Jasper, S. E., Parkinson, P. D., Mavinic, D. S. (1990). Organic contaminants in Canadian coal wastewaters and associated sediments. Water Pollution Research Journal of Canada 25(2):187-200. |
| **HERO ID:** | 1315873 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology is fully explained |
| | Metric 2: | Analytical Methodology | Medium | Detection limits were somewhat reported, but are overall unclear. Authors noted that for wastewater, a lower limit LOQ of 10ug/L was established, as well as a practical detection limit of 5ug/L (pg 192). For sediment, a detection limit of 0.1ug/g was established (pg 192). It is unclear if these limits apply to all chemicals analyzed. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical measured in sediment and wastewater |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Canada |
| | Metric 5: | Currency | Low | Samples were collected from 1982 to 1984 |
| | Metric 6: | Spatial and Temporal Variability | Low | Samples were grab samples. No replicates. |
| | Metric 7: | Exposure Scenario | High | Samples taken from coal operations |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data points not reported |
| | Metric 9: | Quality Assurance | Low | Study has a quality control section. Recoveries ranged from 46 to 132% and not specified by individual chemicals. Authors did assert that this is an acceptable range. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited characterization of variance and some discussion of limitations. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Camanzo, J., Rice, C. P., Jude, D. J., Rossmann, R. (1987). Organic priority pollutants in nearshore fish from 14 Lake Michigan USA tributaries and embayments 1983. Journal of Great Lakes Research 13(3):296-309. |
| **HERO ID:** | 1315876 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology is discussed and pertinent sampling information is provided in the data source such as sampling equipment, sampling procedures, sample storage conditions and sampling sites. |
| | Metric 2: | Analytical Methodology | High | Samples were extracted according to publicly available US EPA SOP. Analytical instrumentation is described. Detection limits provided. |
| | Metric 3: | Biomarker Selection | N/A | The study is testing the parent chemical in fish. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Geographic location is reported and discussed. Figure 1 also shows all 14 collection sites throughout Michigan, U.S. |
| | Metric 5: | Currency | Low | Timing of sample collection is not consistent with current or recent exposures may be expected (> 15 years). Sampling period was in 1983. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Sampling approach accurately captures variability. The study used a large sample size (14 sites, 3 to 11 fish per composite sample), and sampling occurred over a sufficient period of time (fall of one year). Some replicate samples are used. |
| | Metric 7: | Exposure Scenario | High | The data represent the relevant exposure scenario (i.e., fish exposure in Lake Michigan). The study describes the setting (location). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Some of the raw data i.e., individual data points are not reported (some of raw data are means of replicates), and therefore summary statistics cannot be reproduced. |
| | Metric 9: | Quality Assurance | Low | The study applied quality assurance/quality control measures; however, one or more pieces of QA/QC information is not described. Recoveries are on the low side 67 to 76% (<70%) but they didn't correct for recovery. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability shown in 14 locations and 2 different fish species per site. Minimal quantitative analysis of variability is discussed such as SD of replicate samples and there is no uncertainty discussion in the study. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Hall, L. W., Jr, Pinkney, A. E., Horseman, L. O., Finger, S. E. (1985). Mortality of striped bass larvae in relation to contaminants and water-quality in a Chesapeake Bay tributary. Transactions of the American Fisheries Society 114(6):861-868. |
| **HERO ID:** | 1315913 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology was discussed in the data source, but lacked a few details. |
| | Metric 2: | Analytical Methodology | Low | Analytic method was provided but no LOD/LOQ was reported. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Chesapeake Bay Tributary |
| | Metric 5: | Currency | Low | April, 1984 |
| | Metric 6: | Spatial and Temporal Variability | Low | 3 river locations were sampled. Replicate samples taken. |
| | Metric 7: | Exposure Scenario | Medium | The data likely represent the relevant exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data were not reported in the main article or SI. Little summary statistics given. |
| | Metric 9: | Quality Assurance | Medium | The study mentioned that quality assurance measures were applied but no details were elaborated. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study has limited discussion of key uncertainties, limitations, variation, and data gaps. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Pitt, R., Field, R., Lalor, M., Brown, M. (1995). Urban stormwater toxic pollutants: Assessment, sources, and treatability. Water Environment Research 67(3):260-275. |
| **HERO ID:** | 1315962 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | The authors reported the sample collection methods and equipment but did not explain the sampling design. Sample storage conditions and duration were also not reported but they referenced a standard EPA method for sample handling and preservation. Authors did report on sampling site characteristics. |
| | Metric 2: | Analytical Methodology | High | The authors cited a standard EPA method for analysis. They also reported the analytical method and detection limit. |
| | Metric 3: | Biomarker Selection | N/A | Measured parent chemical in urban stormwater |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Birmingham, Alabama |
| | Metric 5: | Currency | Low | The article did not report a sample collection date, but the publication date is 1995. |
| | Metric 6: | Spatial and Temporal Variability | Medium | The authors collected and analyzed 87 samples. The authors did not report collecting replicate samples. |
| | Metric 7: | Exposure Scenario | High | The exposure scenario is relevant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | The authors report the detection frequency, number of samples, mean and range. They did not report a standard deviation. The authors did not report the individual sample concentrations. |
| | Metric 9: | Quality Assurance | Low | The authors do not mention explicitly anything about QA/QC procedures but they did report following a standard EPA protocol for their analysis. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The authors did not report a standard deviation, but did have a range. There was some discussion of uncertainties, limitations, and data gaps. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Guidotti, M., Colasanti, G., Chinzari, M., Ravaioli, G., Vitali, M. (1998). Investigation on the presence of aromatic hydrocarbons, polycyclic aromatic hydrocarbons, persistent organochloride compounds, phthalates and the breathable fraction of atmospheric particulate in the air Rieti urban area. Annali di Chimica 88(5-6):419-427. |
| **HERO ID:** | 1315986 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Missing storage conditions and calibration |
| | Metric 2: | Analytical Methodology | Low | Analytical methods described briefly. LOQ or LOD not reported |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Italy |
| | Metric 5: | Currency | Low | Published in 1998 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Includes replicates, but less than 10 samples collected per pollutant of interest |
| | Metric 7: | Exposure Scenario | Low | No detailed description of the source of pollution and microenvironment |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only average given- no summary statistics presented, missing standard deviation |
| | Metric 9: | Quality Assurance | Low | Blanks were used , recoveries not reported, limited discussion on quality assurance |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability in seasons measured. Limitations and key uncertainties are not discussed |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Monsanto, (1983). Investigation of phthalate ester concentrations in a Michigan sewage pond. |
| **HERO ID:** | 1316180 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Only briefly described. Missing most sampling information |
| | Metric 2: | Analytical Methodology | Low | Referenced Environmental Sciences Methods ES-78-M7 and ES-78-M6. LOD not reported |
| | Metric 3: | Biomarker Selection | N/A | Tested for parent chemical in Daphnia and water lagoon |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Michigan, USA |
| | Metric 5: | Currency | Low | Published in 1983. No sampling date |
| | Metric 6: | Spatial and Temporal Variability | Low | 3 Daphnia samples, 6 water samples (Table 1), no replicates |
| | Metric 7: | Exposure Scenario | Low | Data lack key pieces of information so unclear how to characterize the exposure scenario |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual concentrations, limited summary statistics |
| | Metric 9: | Quality Assurance | Low | Analyzed control samples, did not describe QA/QC techniques |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Did not characterize variance nor discuss uncertainties and study limitations |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | TDH, (1982). Study plan and data on hexachlorocyclopentadiene from 8 fish samples analyzed by GC/MS with cover letter dated 082082. |
| **HERO ID:** | 1316227 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling methods only briefly described |
| | Metric 2: | Analytical Methodology | Critically Deficient | Analytical methods are not described |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | USA |
| | Metric 5: | Currency | Low | Published in 1982 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 6 samples from 12 sampling sites |
| | Metric 7: | Exposure Scenario | Medium | Data likely represent relevant exposure scenarios, missing details about the population of interest |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only individual sample concentrations, no summary statistics |
| | Metric 9: | Quality Assurance | Low | QA/QC techniques only briefly discussed |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability only briefly discussed, uncertainties and study limitations not discussed |

## Overall Quality Determination — Uninformative

| | |
|---|---|
| **Study Citation:** | Hazleton Labs, (1986). Pollutant analyses on effluent discharge - phenol - with cover letter dated 072387. |
| **HERO ID:** | 1316229 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Critically Deficient | Sampling methods not described |
| | Metric 2: | Analytical Methodology | Critically Deficient | Analytical methods not described |
| | Metric 3: | Biomarker Selection | N/A | The authors analyzed environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Wisconsin, USA |
| | Metric 5: | Currency | Low | Sampling in 1986 |
| | Metric 6: | Spatial and Temporal Variability | Critically Deficient | Sample size is not reported |
| | Metric 7: | Exposure Scenario | Low | Data lacks key pieces of information and this impacts the exposure scenario characterization |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only individual sample concentrations, no summary statistics |
| | Metric 9: | Quality Assurance | Low | QA/QC techniques were not discussed |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability was not characterized, uncertainties and limitations were not discussed |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Ciba-Geigy, (1987). Briefing for the assistant administrator - Record for decision on the Lone Pine Landfill. |
| **HERO ID:** | 1316232 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Critically Deficient | Sampling methodology not described |
| | Metric 2: | Analytical Methodology | Critically Deficient | Analytical methodology not described |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | New Jersey |
| | Metric 5: | Currency | Low | Published in 1987 |
| | Metric 6: | Spatial and Temporal Variability | Critically Deficient | Sample size is not reported |
| | Metric 7: | Exposure Scenario | Low | Data may represent a relevant exposure scenario but lacks key data details to support its validity |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Only reported maximum concentrations detected, no summary statistics |
| | Metric 9: | Quality Assurance | Low | QA/QC details not discussed |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability, uncertainties and limitations were not characterized |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Geraghty & Miller Inc, (1990). Phase II - Site investigation: Borden site Carson, California (volume I) with attached appendices and cover letter dated 032790. |
| **HERO ID:** | 1316237 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling methodology only briefly described |
| | Metric 2: | Analytical Methodology | Critically Deficient | Not described |
| | Metric 3: | Biomarker Selection | N/A | the study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | California |
| | Metric 5: | Currency | Low | Sampling began in 1987 |
| | Metric 6: | Spatial and Temporal Variability | Low | 10 soil samples, 15 water samples |
| | Metric 7: | Exposure Scenario | High | Provided an exposure assessment |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual sample concentrations, no summary statistics |
| | Metric 9: | Quality Assurance | High | Detailed QA/QC description |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability was not characterized, uncertainties were briefly discussed |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Ecology and Environment, (1991). Letter from Vulcan Chemicals to USEPA submitting enclosed final report concerning RCRA facility assessment with tetrachloroethylene and trichloromethane with attachments. |
| **HERO ID:** | 1316245 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Well described sampling methods |
| | Metric 2: | Analytical Methodology | Critically Deficient | Analytical methodology was not described |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected in USA |
| | Metric 5: | Currency | Low | Published in 1991 |
| | Metric 6: | Spatial and Temporal Variability | Low | n=15, no replicates |
| | Metric 7: | Exposure Scenario | Medium | Limited description about the population of interest |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only individual sample concentrations, no summary statistics |
| | Metric 9: | Quality Assurance | Low | Only briefly described |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Did not characterize variability or discussed uncertainties and limitations |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Ritsema, R., Cofino, W. P., Frintrop, P. C., Brinkman, U. A. (1989). Trace-level analysis of phthalate esters in surface water and suspended particulate matter by means of capillary gas chromatography with electron-capture and mass-selective detection. Chemosphere 18(11-12):2161-2176. |
| **HERO ID:** | 1316257 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | describe sampling instruments, sites, and procedures |
| | Metric 2: | Analytical Methodology | High | discuss analytical method and instruments, recoveries >70%, report detection limit |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in an environmental media (water). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | the Netherlands (Rhine River and Lake Yesel) |
| | Metric 5: | Currency | Low | 1986 |
| | Metric 6: | Spatial and Temporal Variability | High | 12 samples from River Rhine and 6 samples from Lake Yesel |
| | Metric 7: | Exposure Scenario | Medium | studying phthalate esters in Dutch inland waters but aren't specific about pollution source |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | no raw data or measures of variation; concentrations presented on bar graph are difficult to read |
| | Metric 9: | Quality Assurance | Medium | procedural blanks but not much discussion about quality control |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | no real discussion of uncertainty; no measures of variability but data shows variability day to day; |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Mcdowell, D. C., Metcalfe, C. D. (2001). Phthalate esters in sediments near a sewage treatment plant outflow in Hamilton Harbour, Ontario: SFE extraction and environmental distribution. Journal of Great Lakes Research 27(1):9-Mar. |
| **HERO ID:** | 1322016 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | sampling described, no map |
| | Metric 2: | Analytical Methodology | High | method limit of detection provided on p.6; equipment and extraction described; methods paper |
| | Metric 3: | Biomarker Selection | N/A | sediment |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Ontario |
| | Metric 5: | Currency | Low | 1997 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 5 samples in triplicate |
| | Metric 7: | Exposure Scenario | Medium | sediments near a sewage treatment plant |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | text page 6 - below MDL |
| | Metric 9: | Quality Assurance | Low | QA not discussed; no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Dargnat, C., Blanchard, M., Chevreuil, M., Teil, M. J. (2009). Occurrence of phthalate esters in the Seine River estuary (France). Hydrological Processes 23(8):1192-1201. |
| **HERO ID:** | 1322123 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | detailed description of site characteristics, collection, storage; referred to EPA method |
| | Metric 2: | Analytical Methodology | High | detailed description of analytical methods and instruments, determined detection limits |
| | Metric 3: | Biomarker Selection | N/A | Surface water sampling |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Seine River estuary in France |
| | Metric 5: | Currency | Medium | 2005-2006 |
| | Metric 6: | Spatial and Temporal Variability | High | used replicates; n = 7 at 5 sampling stations so 35+ samples (Figure 2) |
| | Metric 7: | Exposure Scenario | High | sewage overflow, runoff, treatment plant discharge |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | no raw data but provide graphs and tables with averages and summary stats; no measure of variation |
| | Metric 9: | Quality Assurance | High | laboratory blanks and used replicates |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | discuss flux due to flooding and variable flows but no measure of standard deviations and no discussion about uncertainties/limits |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Ebinghaus, R., Xie, Z. (2006). Occurrence and air/sea-exchange of novel organic pollutants in the marine environment. Journal de Physique IV 139:211-237. |
| **HERO ID:** | 1322127 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | detailed description of sample instrumentation, filtration, sampling stations, etc. |
| | Metric 2: | Analytical Methodology | High | describe analytical instruments and detection limits |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in an environmental media (water and air). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | North Sea |
| | Metric 5: | Currency | Low | 2004 |
| | Metric 6: | Spatial and Temporal Variability | High | 40 sampling stations, 11 water samples, 3 air samples (collected in duplicate) |
| | Metric 7: | Exposure Scenario | High | phthalates in the North Sea, toxic to aquatic organisms |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | thorough with raw results, averages, standard deviations |
| | Metric 9: | Quality Assurance | High | included blanks and standards |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | include standard deviation but there appears to be a large variation and not much discussion about uncertainty or limitations |

## Overall Quality Determination High

**Study Citation:** Olujimi, O. O., Fatoki, O. S., Odendaal, J. P., Daso, A. P. (2012). Chemical monitoring and temporal variation in levels of endocrine disrupting chemicals (priority phenols and phthalate esters) from selected wastewater treatment plant and freshwater systems in Republic of South Africa. Microchemical Journal 101(Elsevier):23-Nov.

**HERO ID:** 1322160

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | six WWTPs; surface water from 5 rivers collected (grab sample) 1 to 2 km upstream and downstream of WWTPs; locations, treatment processes, and people equivalence described in Table 1; collected with 1L glass bottles; samples kept cold on ice; extracted and analyzed within 12 h |
| | Metric 2: | Analytical Methodology | Low | SPE; GC-MS; detection limit not provided; does not discuss recovery samples for this study |
| | Metric 3: | Biomarker Selection | N/A | Water sampling |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Athlone (Vygekraal River); Bellville (Kuils River); Kraaifontein (Mosselbank River); Potsdam (Diep River); Zandvliet (Kuils River) and Stellenbosch (Veldwachters River), South Africa |
| | Metric 5: | Currency | Low | sampling date not provided; published in 2012 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 6 WWTPs and rivers; 108 samples per site - upstream, influent, effluent and downstream; sampled each quarter (summer, autumn, winter, and spring. No indication of replicate sampling or analysis |
| | Metric 7: | Exposure Scenario | High | surface water from rivers collected upstream and downstream of WWTP that emptied final effluents into the rivers; concentrations of influent and effluent of WWTP |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | seasonal mean and standard error reported per quarter and per site (Tables 2, 3, 4, 5, 6, and 7) |
| | Metric 9: | Quality Assurance | Medium | compare results to control site (Table 7 - Kirstenbosch Botanical Garden) |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | discusses variability by season and site; compares findings to previous studies |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Kolarik, B., Bornehag, C. G., Naydenov, K., Sundell, J.,an, Stavova, P., Nielsen, O. (2008). The concentrations of phthalates in settled dust in Bulgarian homes in relation to building characteristic and cleaning habits in the family. Atmospheric Environment 42(37):8553-8559. |
| **HERO ID:** | 1322255 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The children taken part of the study were selected from the ALLHOME-I. Sampling of settled dust was performed in the child'sroom, above the floor level by using a vacuum cleaner equipped with a phthalate-free ALK dust collector and filter. |
| | Metric 2: | Analytical Methodology | Medium | LOD not reported, the analytical methodology is described |
| | Metric 3: | Biomarker Selection | High | Urine BBzP |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Bulgaria |
| | Metric 5: | Currency | Medium | 2004-2005 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 177 homes of Bulgarian children, no sample replicates |
| | Metric 7: | Exposure Scenario | High | The concentrations of phthalates in settled dust in Bulgarianhomes in relation to building characteristic and cleaninghabits in the family |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No war data. Table 1 The concentrations of phthalates (mg g1 dust) measured in 177 homes of Bulgarian children GM (95%CI), median |
| | Metric 9: | Quality Assurance | Critically Deficient | QA no reported in any of the cohort studies |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Key limitations no reported. Variability presented as 95% CI |

## Overall Quality Determination — Uninformative

| | |
|---|---|
| **Study Citation:** | Tsumura, Y., Ishimitsu, S., Kaihara, A., Yoshii, K., Tonogai, Y. (2002). Phthalates, adipates, citrate and some of the other plasticizers detected in Japanese retail foods: a survey. Journal of Health Science 48(6):493-502. |
| **HERO ID:** | 1325814 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Minimal sampling details- it is unclear if same brands used or not. |
| | Metric 2: | Analytical Methodology | High | extraction and equipment described for each type of food; LOD in Table 3 |
| | Metric 3: | Biomarker Selection | N/A | food |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Japan |
| | Metric 5: | Currency | Low | 2000-2001 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 3 to 11 per food type, 93 samples total; unclear if there are replicates |
| | Metric 7: | Exposure Scenario | High | food |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | median, minimum and maximum included. Individual data not reported. |
| | Metric 9: | Quality Assurance | High | QA not discussed-recoveries assessed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | uncertainty not discussed, no obvious concerns; variability shown through 19 different food types |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Fierens, T., Van Holderbeke, M., Willems, H., De Henauw, S., Sioen, I. (2013). Transfer of eight phthalates through the milk chain - A case study. Environment International 51:7-Jan. |
| **HERO ID:** | 1332529 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | sampling sites and methods described in detail |
| | Metric 2: | Analytical Methodology | High | LOQ in table 2, extraction and equipment described in detail |
| | Metric 3: | Biomarker Selection | N/A | food - milk |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Belgium |
| | Metric 5: | Currency | Medium | 2010-2011 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 1 to 10 for 17 different sample types, no replicates |
| | Metric 7: | Exposure Scenario | High | milk, butter, cheese |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | min, max, and median included |
| | Metric 9: | Quality Assurance | Medium | QA briefly described, not reported no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability included via different sample types, uncertainty not described, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Santhi, V. A., Mustafa, A. M. (2013). Assessment of organochlorine pesticides and plasticisers in the Selangor River basin and possible pollution sources. Environmental Monitoring and Assessment 185(2):1541-1554. |
| **HERO ID:** | 1332544 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | 4L grab samples from depth of 0.5m collected glass bottles from 7 sampling sites (fig 1); filtered; stored at 4C in dark and analyzedwithin 48 h |
| | Metric 2: | Analytical Methodology | High | sample percolated through a cartridge; GC-MS; LOD and recoveries(Table 1) |
| | Metric 3: | Biomarker Selection | N/A | Water samples, biomarker not needed. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Selangor River, Malaysia |
| | Metric 5: | Currency | Medium | November 2008 - July 2009 |
| | Metric 6: | Spatial and Temporal Variability | High | 7 sampling sites; n=4 at each site; taken at rainy ad dry season; total of 28 samples across sites per season. Duplicate samples were analyzed, but unclear how many dups were done if samples were collected in dups or analyzed in dups |
| | Metric 7: | Exposure Scenario | High | measuring surface water for a river in the most industrialized state in Malaysia which provides over 60% of the potable water |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 3 provides the mean at each site during rainy and dry season; DF discussed p. 1548 |
| | Metric 9: | Quality Assurance | High | procedural blank, spiked blank and duplicate samples; recovery % Table 1 |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | compared to other studies and locations (Table 5); compared variation between rainy and dry season; std deviation Table 1 |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Rohm and Haas, (1981). Landfill monitoring wells and stream survey attach cover letter. |
| **HERO ID:** | 1332944 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Critically Deficient | Sampling methods not described |
| | Metric 2: | Analytical Methodology | Critically Deficient | Analytical methods not described |
| | Metric 3: | Biomarker Selection | N/A | Landfill samples no biomarker needed. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | Critically Deficient | Geographic location not reported |
| | Metric 5: | Currency | Low | Published in 1982 |
| | Metric 6: | Spatial and Temporal Variability | Low | 7 sampling sites, no replicates |
| | Metric 7: | Exposure Scenario | Low | Lack of location details, population of interest and methods make this metric uncertain. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only individual sample concentration data, no summary statistics |
| | Metric 9: | Quality Assurance | Low | QA/QC was not discussed |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability, uncertainties and limitations were not discussed |

## Overall Quality Determination Uninformative

**Study Citation:** ERM, (1988). Hydrogeological investigation at the Union Carbide solvents and materials coating plant with cover letter dated 070688.
**HERO ID:** 1332986

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Only briefly described |
| | Metric 2: | Analytical Methodology | Critically Deficient | Analytical methods not described |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | USA |
| | Metric 5: | Currency | Low | Sampling began in 1985 |
| | Metric 6: | Spatial and Temporal Variability | Critically Deficient | Sample size not reported |
| | Metric 7: | Exposure Scenario | Low | The exposure scenario is unclear |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Individual sample concentrations, no summary statistics |
| | Metric 9: | Quality Assurance | Medium | Limited description of QA/QC techniques, analyzed control samples |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and uncertainties were not characterized |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Jacobs, M. W., Coates, J. A., Delfino, J. J., Bitton, G., Davis, W. M., Garcia, K. L. (1993). Comparison of sediment extract microtox{\textregistered} toxicity with semi-volatile organic priority pollutant concentrations. Archives of Environmental Contamination and Toxicology 24(4):461-468. |
| **HERO ID:** | 1333591 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some sampling information missing, such as exact site location. |
| | Metric 2: | Analytical Methodology | Low | extractions were modifications of US EPA Method 3550 and a method developed by Marble and Delfino (1988). equipment described; no LOD |
| | Metric 3: | Biomarker Selection | N/A | sediment |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | U.S. Florida |
| | Metric 5: | Currency | Low | 1989-1990 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 105 sediments, no replicates |
| | Metric 7: | Exposure Scenario | Low | sediments- no details given on exposure scenarios |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | mean, median, range included. Individual points not reported. |
| | Metric 9: | Quality Assurance | Low | QA not discussed, no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and Uncertainty not discussed, no obvious concerns. No limitations reported. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Bono-Blay, F., Guart, A., de la Fuente, B., Pedemonte, M., Pastor, M. C., Borrell, A., Lacorte, S. (2012). Survey of phthalates, alkylphenols, bisphenol A and herbicides in Spanish source waters intended for bottling. Environmental Science and Pollution Research 19(8):3339-3349. |
| **HERO ID:** | 1333834 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | sampled water sources (springs and boreholes) - Table 2; from boreholes 24 and 400 m depth; 1L collected using glass bottle and capped; stored room temp until analysis within 15 days; samples unfiltered |
| | Metric 2: | Analytical Methodology | High | SPE; GC-MS; recoveries; LOD and LOQ provided Table 3 |
| | Metric 3: | Biomarker Selection | N/A | Measured parent chemical in source water |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | all over Spain; specific regions provided in Table 2 |
| | Metric 5: | Currency | Medium | 2007 - 2008 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 131 water sources (40 springs;91 boreholes) all over Spain; sampled from 2007 to 2008. No replicates |
| | Metric 7: | Exposure Scenario | High | concentrations in source waters intended for bottling (spring waters and boreholes) |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data. Table 4 provides n, DF, range, mean, and SD |
| | Metric 9: | Quality Assurance | High | recoveries ranged from 77-124% (Table 3); blank analysis. Explained how background contamination was corrected. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | no discussion of uncertainties, limitation, data gaps |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Asakura, H., Matsuto, T., Tanaka, N. (2004). Behavior of endocrine-disrupting chemicals in leachate from MSW landfill sites in Japan. Waste Management 24(6):613-622. |
| **HERO ID:** | 1333892 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | landfill leachate sampled at two sites 4 times over a year and half; sampling points (fig 1); collected using a bucket or ladle; stored and sealed in glass bottles; filtered; storage temp and duration not defined |
| | Metric 2: | Analytical Methodology | High | liquid liquid or cartridge extraction (Table 2); GC/MS; recoveries; LOD reported Table 4 |
| | Metric 3: | Biomarker Selection | N/A | Parent chemicals were tested in landfill leachate |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Japan |
| | Metric 5: | Currency | Low | 2000 and 2001 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 2 landfills sampled 4 times over a year and half; total number of samples for raw leachate (17), processed leachate (24). No replicates |
| | Metric 7: | Exposure Scenario | High | concentration in leachate from two MSW landfills sampled over a year and half to determine seasonal-variation; sampling points within and along the leachate treatment facilities (Fig 1) |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 4 provides the concentration range and DF for raw leachate and processed leachate from the two sites combined; Fig 3 provides DEHP concentration by landfill (range, median, average, and DF). No raw data |
| | Metric 9: | Quality Assurance | Low | Blanks were tested. Recoveries for phthalates, alkylphenols, and BPA ranged between 60 and 80%; no details provided on recoveries for individual chemicals and correction. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | compared concentration between raw, within process, and effluent; discussed seasonal changes; and compared between sites. Some characterization of variance and limited discussion of gaps and uncertainties. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Chem-Dyne, (1987). CRA sampling and analytical tables on nine chemicals with attachments. |
| **HERO ID:** | 1335590 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Critically Deficient | Sampling methodology not reported |
| | Metric 2: | Analytical Methodology | Critically Deficient | Analytical methodology is not described |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Hamilton, Ohio |
| | Metric 5: | Currency | Low | 1984 |
| | Metric 6: | Spatial and Temporal Variability | Critically Deficient | Sample size not reported or hard to read |
| | Metric 7: | Exposure Scenario | Critically Deficient | The exposure scenario is not reported |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Critically Deficient | There is no explanation regarding the data |
| | Metric 9: | Quality Assurance | Medium | the study reports key QA parameters |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Critically Deficient | Key limitations or sample variability not reported |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Teil, M. J., Blanchard, M., Dargnat, C., Larcher-Tiphagne, K., Chevreuil, M. (2007). Occurrence of phthalate diesters in rivers of the Paris district (France). Hydrological Processes 21(18):2515-2525. |
| **HERO ID:** | 1337950 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | info about sampling sites, sampling filters, treatments, storage |
| | Metric 2: | Analytical Methodology | High | include detection limits; detailed description of analytical instruments and methods |
| | Metric 3: | Biomarker Selection | N/A | Water sampling |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Paris (River Seine, River Marne, River Oise) |
| | Metric 5: | Currency | Low | 2002-2004 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 85, no indication of replicate sampling or analysis |
| | Metric 7: | Exposure Scenario | Medium | thought to be related to population density, wastewater treatment plants, and industrial distribution |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | include averages at each site and range limits but no raw data; also include annual variation in chemical concentration |
| | Metric 9: | Quality Assurance | Low | assumed but no discussion of blanks/controls |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | display annual variability but no discussion of uncertainties and limits |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Antizar-Ladislao, B. (2009). Polycyclic aromatic hydrocarbons, polychlorinated biphenyls, phthalates and organotins in northern Atlantic Spain's coastal marine sediments. Journal of Environmental Monitoring 11(1):85-91. |
| **HERO ID:** | 1338995 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported that followed standard methods at an accredited laboratory. |
| | Metric 3: | Biomarker Selection | N/A | Measured parent chemical in marine sediment |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Cantabria, North Spain |
| | Metric 5: | Currency | Medium | Samples collected in 2007 |
| | Metric 6: | Spatial and Temporal Variability | High | >10 samples, triplicates |
| | Metric 7: | Exposure Scenario | High | Exposure sources characterized throughout the paper. Exposure to marine sediments that are fishing points is relevant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data reported in the manuscript but missing most summary statistics. |
| | Metric 9: | Quality Assurance | Medium | Standard QA/QC procedures but not completely reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Gaps and limitations not well characterized. Variance not characterized. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Hargis, (1986). Phase III: Investigation of groundwater quality and hydrogeologic conditions, Summa Corporation Facility, Culver City, California (final report) with attach and letter dated 013192. |
| **HERO ID:** | 1356129 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling methods briefly described |
| | Metric 2: | Analytical Methodology | Medium | Cited EPA method 624, included LOD, did not describe the method |
| | Metric 3: | Biomarker Selection | N/A | Did not test for biomarkers |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | California, USA |
| | Metric 5: | Currency | Low | Samples from 1985 |
| | Metric 6: | Spatial and Temporal Variability | Critically Deficient | Sample size was not reported |
| | Metric 7: | Exposure Scenario | Medium | Data may represent a relevant exposure scenario but the report doesn't have details about the population or microenvironment of interest |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual sample concentrations, no summary statistics |
| | Metric 9: | Quality Assurance | Medium | Limited description of QA/QC techniques |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and uncertainty were not characterized |

## Overall Quality Determination — Uninformative

| | |
|---|---|
| **Study Citation:** | Westinghouse Electric Corporation, (1991). Hydrogeological investigation of the Hoechst Celanese facility Spartanburg, South Carolina - Westinghouse project 4122-90-022A with attachments and cover letter dated 052291. |
| **HERO ID:** | 1356133 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Well described sampling methods |
| | Metric 2: | Analytical Methodology | Low | Limited description of analytical methods |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | USA |
| | Metric 5: | Currency | Low | Report from 1991 |
| | Metric 6: | Spatial and Temporal Variability | Critically Deficient | Sample size not reported |
| | Metric 7: | Exposure Scenario | Medium | Missing details about the population of interest |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual sample concentrations only |
| | Metric 9: | Quality Assurance | Medium | Analyzed control samples, techniques briefly described |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and uncertainties were not characterized |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Great Lakes Chemical Corp, (1987). Exposure assessment for hazardous waste landfill with cover letter dated 072187. |
| **HERO ID:** | 1356178 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling methodology not described, only briefly mentioned |
| | Metric 2: | Analytical Methodology | High | Analytical reports included in the appendix |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | El Dorado, AR |
| | Metric 5: | Currency | Low | 1986 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 7 waste samples analyzed along with air samples collected in the months of Jan-March (33 samples) and May 1985 (14 days). No replicates. |
| | Metric 7: | Exposure Scenario | High | Report characterizes facility and sources as well as nearby residential communities and explores various exposure pathways through different medias. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data points available for waste samples but only monthly averages and summaries available for air samples. No other statistics were used |
| | Metric 9: | Quality Assurance | Low | QA/QC was not mentioned but lab reports for analyses and air data from the Arkansas Dept of Pollution Control Ecology imply SOP and methods. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Key limitations and data gaps not addressed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Jackson, J., Sutton, R. (2008). Sources of endocrine-disrupting chemicals in urban wastewater, Oakland, CA. Science of the Total Environment 405(1-3):153-160. |
| **HERO ID:** | 1408465 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methods were described and a map of study area was included. |
| | Metric 2: | Analytical Methodology | Low | Samples were analyzed using well-established method EPA 625; LOD was not reported. |
| | Metric 3: | Biomarker Selection | N/A | The analyte measured is the TSCA chemical. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in the United States. |
| | Metric 5: | Currency | Medium | Samples were collected in 2006. |
| | Metric 6: | Spatial and Temporal Variability | Medium | There are 16 wastewater samples. No replicates were reported. |
| | Metric 7: | Exposure Scenario | Low | The sources of exposure were not well characterized, the data closely represent a relevant wastewater exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were reported, but no LOD was provided. |
| | Metric 9: | Quality Assurance | Low | Key QA process reported included used of field blanks. Quality control was not discussed, but there was no obvious concerns. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and uncertainty were not discussed, but there was no obvious concerns of study quality. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Tan, B. L., Hawker, D. W., Müller, J. F., Tremblay, L. A., Chapman, H. F. (2008). Stir bar sorptive extraction and trace analysis of selected endocrine disruptors in water, biosolids and sludge samples by thermal desorption with gas chromatography-mass spectrometry. Water Research 42(1-2):404-412. |
| **HERO ID:** | 1411500 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | sampling described, missing a few details like materials used and contamination prevention for phthalates |
| | Metric 2: | Analytical Methodology | High | extraction and equipment described; LOD in Table 2 footnotes |
| | Metric 3: | Biomarker Selection | N/A | environmental samples |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Australia |
| | Metric 5: | Currency | Low | Grab samples were taken at two different times (November 2004 and March 2005 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 1 for each date and sampling station. Three replicates for the experimental part, no replicates for environmental monitoring |
| | Metric 7: | Exposure Scenario | High | raw influent and biosolids, unclear if it applies to US |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | raw data in Table 2 |
| | Metric 9: | Quality Assurance | High | Analytical QA discussed, no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

**Study Citation:** Tan, B. L., Hawker, D. W., Müller, J. F., Leusch, F. D., Tremblay, L. A., Chapman, H. F. (2007). Comprehensive study of endocrine disrupting compounds using grab and passive sampling at selected wastewater treatment plants in South East Queensland, Australia. Environment International 33(5):654-669.

**HERO ID:** 1412614

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Authors described the sampling sites, equipment, procedure, and storage conditions. |
| | Metric 2: | Analytical Methodology | Medium | Authors described GC-MS procedure, instrumentation, extraction methods, and recoveries. However, LODs were only reported as a range for all chemicals combined. |
| | Metric 3: | Biomarker Selection | N/A | The study tested for parent chemicals in wastewater treatment plants. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in southeast Queensland, Australia |
| | Metric 5: | Currency | Medium | Samples were collected in 2005. |
| | Metric 6: | Spatial and Temporal Variability | High | 15 grab samples were collected from 5 different sites on 3 sampling days in duplicate. |
| | Metric 7: | Exposure Scenario | High | The WWTPs studied discharge their effluent into rivers, creeks, dams, or the open sea. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Mean concentrations, standard deviation, and sample size for each site were reported, but raw data are missing. |
| | Metric 9: | Quality Assurance | Medium | Some QA/QC procedures discussed, such as recovery ranges which were acceptable. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Authors used standard deviations to characterize variance. There was some discussion, albeit limited, on uncertainties, data gaps, and limitations. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Brossa, L., Marcé, R. M., Borrull, F., Pocurull, E. (2005). Occurrence of twenty-six endocrine-disrupting compounds in environmental water samples from Catalonia, Spain. Environmental Toxicology and Chemistry 24(2):261-267. |
| **HERO ID:** | 1418117 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | describe sampling site, equipment, filtration, storage |
| | Metric 2: | Analytical Methodology | Medium | used SPE-GC-MS; mention detection limits but not what they were for each chemical |
| | Metric 3: | Biomarker Selection | N/A | Tested for parent chemical in surface water |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Catalonia, Spain |
| | Metric 5: | Currency | Low | 2001-2002 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 72 total, no replicates |
| | Metric 7: | Exposure Scenario | High | Sampled river water that is a source of tap water, irrigation canal used for agriculture, and seawater that is a recreational site |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | no individual sample concentrations but did report min-max in table and average in text |
| | Metric 9: | Quality Assurance | Low | QA/QC can be assumed but not discussed |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | report range but missing discussion of uncertainties or limitations |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Koch, H. M., Lorber, M., Christensen, K. L. Y., Pälmke, C., Koslitz, S., Brüning, T. (2013). Identifying sources of phthalate exposure with human biomonitoring: Results of a 48h fasting study with urine collection and personal activity patterns. International Journal of Hygiene and Environmental Health 216(6):672-681. |
| **HERO ID:** | 1464613 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Each participant collected all urine voids over a 48-hr fasting period. Each void stored separately, frozen at -18 °C; collection bags phthalate free. Also pre- and post-fast voids collected. Creatine adjusted. |
| | Metric 2: | Analytical Methodology | Medium | Deconjugated, internal isotope standards, and LC/LC-MS/MS using methods of Koch et al. (2003, 2007) and Preuss et al. (2005). LOD and LOQ reported. Instrument calibration missing but may be detailed in the methods referenced in the previous sentence. |
| | Metric 3: | Biomarker Selection | High | Table 1 lists parent chemicals and their metabolites. Four metabolites of DEHP analyzed in urine: MEHP, MECPP, MEOHP, and MEHHP. It seems like the study is measuring each metabolite from the chemicals of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Germany, Bochum. |
| | Metric 5: | Currency | Medium | 2009 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Five adults (2 male, 3 female) participated. All urine voided over 48-hr fasting period collected. No replicates. |
| | Metric 7: | Exposure Scenario | High | Study to examine exposure via medications and personal care products without contribution of foods or beverages to phthalate exposure. No known occupational exposures. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Reported mean, (SD), median, and 95th percentile values as well as detection frequency (Table 2). Metabolite concentrations normalized to creatinine. Raw data by individual subject presented graphically in Supplemental materials. |
| | Metric 9: | Quality Assurance | High | Quality control, prepared from pooled native urine, and reagent blank samples included in each analytic batch. The lab participated in the EU Consortium to Perform Human Biomonitoring on a European Scale (COPHES). Creatinine concentrations measured by Jaffe method. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Supplemental materials show individual variation in pattern of metabolite concentrations for each urine void collected over 48-hr period (and pre and post). Discussed uncertainties and variability in results relative to other studies and to daily diaries of product use. SD reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | ICI Americas Inc, (1990). Letter from ICI Americas Inc to USEPA submitting initial submission concerning phenol in groundwater with attachments. |
| **HERO ID:** | 1481739 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | No aspects of sampling methodology are described, but field and trip blanks are reported. |
| | Metric 2: | Analytical Methodology | Low | September samples show method of analysis as "EPA, GC." EPA method 624, LOD reported in page 10, for November samples. January samples list method of analysis as "EPA." Instrument calibration and recoveries are not discussed. |
| | Metric 3: | Biomarker Selection | N/A | They analyzed parent chemicals in water. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Hopewell, Virginia |
| | Metric 5: | Currency | Low | 1990 |
| | Metric 6: | Spatial and Temporal Variability | Low | Samples were collected in September (but none were analyzed for this chemical), December (of the 8 samples reported, 4 appear to have been analyzed for this chemical, along with 2 blanks), and January (4 samples, none analyzed for this chemical). No replicates identified. |
| | Metric 7: | Exposure Scenario | High | Primarily groundwater monitoring at ICI Americas, Inc., along with monitoring for VOCs in a potable water tank and water from a water fountain. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Only individual data reported for the 3 monitoring surveys, no summary statistics. |
| | Metric 9: | Quality Assurance | Low | The report doesn't include any QA/QC parameter for sample analysis, but does mention they followed an EPA method. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability is shown in the concentrations across three monitoring studies, but it is not discussed. There is not information regarding key limitations. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Frederiksen, H., Nielsen, J. K., Mørck, T. A., Hansen, P. W., Jensen, J. F., Nielsen, O., Andersson, A. M., Knudsen, L. E. (2013). Urinary excretion of phthalate metabolites, phenols and parabens in rural and urban Danish mother-child pairs. International Journal of Hygiene and Environmental Health 216(6):772-783. |
| **HERO ID:** | 1588874 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most key criteria met. Duration of sample storage prior to analysis lacking. |
| | Metric 2: | Analytical Methodology | High | Key criteria met. |
| | Metric 3: | Biomarker Selection | High | Metabolites specific for parent chemicals. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Denmark. |
| | Metric 5: | Currency | Medium | Sampling in 2011. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 145 participants, single first morning urine samples, urban and rural. |
| | Metric 7: | Exposure Scenario | High | Participant demographic characteristics reported. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Most key criteria met. Lack of raw data. |
| | Metric 9: | Quality Assurance | High | Key criteria met. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Statistical variability reported within summary measures, lacking robust discussion of potential study limitations. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Enke, U., Schleussner, E., Pälmke, C., Seyfarth, L., Koch, H. M. (2013). Phthalate exposure in pregnant women and newborns - The urinary metabolite excretion pattern differs distinctly. International Journal of Hygiene and Environmental Health 216(6):735-742. |
| **HERO ID:** | 1588876 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most key criteria met. Duration of sample storage prior to analysis lacking. |
| | Metric 2: | Analytical Methodology | Medium | Most key criteria met and LOQs reported. Recovery data lacking. |
| | Metric 3: | Biomarker Selection | High | Metabolites specific for parent chemicals. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Germany. |
| | Metric 5: | Currency | Medium | Samples collected 2008-2010. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Total samples (n=47) from women (n=7) during pregnancy and those women (n=9) with newborns providing first urine (n=9) and urine on days 2-5 (n=20); some replicate sampling from pregnant women (3-12 replicates), non-statistical sampling approach. |
| | Metric 7: | Exposure Scenario | High | Participant demographic characteristics reported and relevant exposure scenario. Children and pregnant women susceptible populations. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Most key criteria met. Lack of raw data. Summary statistics provided. |
| | Metric 9: | Quality Assurance | Medium | Most key criteria met, QA considerations in sampling equipment reported. Lack of recovery data. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Statistical variability reported within summary measures, discussion of potential reasons for results, however robust discussion of study limitations. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Zeman, F. A., Boudet, C., Tack, K., Floch Barneaud, A., Brochot, C., Péry, A. R., Oleko, A., Vandentorren, S. (2013). Exposure assessment of phthalates in French pregnant women: Results of the ELFE pilot study. International Journal of Hygiene and Environmental Health 216(3):271-279. |
| **HERO ID:** | 1588878 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Urine samples of the mothers were collected in high-densitypolyethylene vials of 250 mL in the delivery room. Several aliquotsof 10 mL were drawn and stored in polypropylene vials at−80C until analysis. |
| | Metric 2: | Analytical Methodology | High | Analytical methodology is described. The limits of quantification (LQ) of each metabolite are presented in Table 2. |
| | Metric 3: | Biomarker Selection | High | Urine MBzP |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | France |
| | Metric 5: | Currency | Medium | 2007 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Sample replicates no reported. 279 urine samples collected. |
| | Metric 7: | Exposure Scenario | High | Exposure of French pregnant women to a large number of phthalates. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data not reported. Table 2. Urinary phthalate metabolites concentrations (ug/L or ug/g creatinine); Median, Mean SD, Minimum, Maximum, 95th percentile (P95). |
| | Metric 9: | Quality Assurance | High | The quality controls consisted in: (1) analyzing blanks (solvent and experimental blank); (2) analyzing quality standards (QC standard), prepared at different concentrations; (3) systematicallyadding concentration of QC standards in a control chart toverify the repeatability and the reproducibility. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Table 2 describes the variability of the population. No key limitations reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Sathyanarayana, S., Alcedo, G., Saelens, B. E., Zhou, C., Dills, R. L., Yu, J., Lanphear, B. (2013). Unexpected results in a randomized dietary trial to reduce phthalate and bisphenol A exposures. Journal of Exposure Science & Environmental Epidemiology 23(4):378-384. |
| **HERO ID:** | 1597638 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | described enrollment, eligibility criteria, and urine collection, food sample selection and storage. |
| | Metric 2: | Analytical Methodology | Low | referred to CDC method 6306.03 for BPA, and HPLC-MS/MS for DEHP and metabolites; briefly described, but no LOD provided |
| | Metric 3: | Biomarker Selection | High | biomarker is metabolite |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | U.S. Seattle |
| | Metric 5: | Currency | Medium | 2011 |
| | Metric 6: | Spatial and Temporal Variability | Medium | urine 3 timepoints (1 timepoint pooled); 10 families |
| | Metric 7: | Exposure Scenario | High | urine |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | GM, 95%CI, % below LOD reported |
| | Metric 9: | Quality Assurance | Medium | blanks included, samples not corrected, lab personnel were blinded |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | 95%CI included; uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Wan, H. T., Leung, P. Y., Zhao, Y. G., Wei, X., Wong, M. H., Wong, C. K. (2013). Blood plasma concentrations of endocrine disrupting chemicals in Hong Kong populations. Journal of Hazardous Materials 261:763-769. |
| **HERO ID:** | 1597652 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling method and storage described. Missing other information on equipment and procedures/regime |
| | Metric 2: | Analytical Methodology | Medium | LOD and LOQ range provided; equipment and extraction described |
| | Metric 3: | Biomarker Selection | N/A | Tested for parent chemicals in plasma, not metabolites or other biomarkers |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Hong Kong |
| | Metric 5: | Currency | Medium | 2010-2011 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 153 blood samples, no replicates |
| | Metric 7: | Exposure Scenario | High | Study described possible exposure sources. It tested parent chemicals in plasma, so people were already exposed |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | mean, SD, median, min, max, and % of samples below LOD provided. No replicates |
| | Metric 9: | Quality Assurance | High | Blanks, standards, and recoveries were described. Recovery percentages were acceptable. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability captured with SD, min and max. Limited discussion of uncertainties and gaps |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Ma, T. T., Christie, P., Luo, Y. M., Teng, Y. (2013). Phthalate esters contamination in soil and plants on agricultural land near an electronic waste recycling site. Environmental Geochemistry and Health 35(4):465-476. |
| **HERO ID:** | 1597686 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling and storage described clearly. |
| | Metric 2: | Analytical Methodology | High | Equipment, methods, detection limits well described. |
| | Metric 3: | Biomarker Selection | N/A | Soil and plant samples no biomarkers needed. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | 2010 |
| | Metric 6: | Spatial and Temporal Variability | High | Each point shown is a mean of 3 replicates. 9 sites |
| | Metric 7: | Exposure Scenario | Medium | sampling site 250meters from an E-waste recycling site |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Numeric data not presented. Concentrations shown in bar graphs |
| | Metric 9: | Quality Assurance | High | Quality discussed: recovery rates, DLs, internal standards, blanks, parallel samples |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability and uncertainty discussed briefly. No concerns. |

## Overall Quality Determination High

**Study Citation:** Beko, G., Weschler, C. J., Langer, S., Callesen, M., Toftum, J., Clausen, G.,eo (2013). Children's phthalate intakes and resultant cumulative exposures estimated from urine compared with estimates from dust ingestion, inhalation and dermal absorption in their homes and daycare centers. PLoS ONE 8(4):e62442.

**HERO ID:** 1597735

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The study described the sampling procedure for dust and urinary sample. Urinary concentration sampling were briefly described in the present study. Storage conditions were described. All pertinent sampling information for indoor dust is provided in the supplementary information in another study of the same cohort, Langer et al., 2010(HERO ID: 1007791). |
| | Metric 2: | Analytical Methodology | High | Analytical methods for both urinary concentrations (LC/MS) and dust concentrations (GC-MS) were provided. Detection limits were reported. (Dust - Langer et al., 2010 supp table S1 HERO ID: 1007791; Urinary - Langer et al., 2013 table 1 HERO ID: 600114). |
| | Metric 3: | Biomarker Selection | High | Biomarker (parent chemical or metabolite) is derived from exposure to the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Odense, Denmark |
| | Metric 5: | Currency | Medium | The dust samples and urinary samples were collected in 2008. |
| | Metric 6: | Spatial and Temporal Variability | High | The study has large sample size and can capture the variability of environmental contamination in population and scenario. |
| | Metric 7: | Exposure Scenario | Medium | The data likely represent the relevant exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Supplementary or raw data or individual data points are not reported. |
| | Metric 9: | Quality Assurance | High | Quality assurance was conducted for both dust concentration and urinary concentration. Recoveries for urinary concentrations were provided in Langer et al 2013 (1600114). Recoveries for dust concentrations were reported in Langer et al 2010 (1007791). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | The study has a robust comparison to other publications and discussion of limitations. It provides evidence for the consistency of the data. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Llompart, M., Sanchez-Prado, L., Pablo Lamas, J., Garcia-Jares, C., Roca, E., Dagnac, T. (2013). Hazardous organic chemicals in rubber recycled tire playgrounds and pavers. Chemosphere 90(2):423-431. |
| **HERO ID:** | 1597738 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported. |
| | Metric 3: | Biomarker Selection | N/A | N/A. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Spain. |
| | Metric 5: | Currency | Medium | Study published in 2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 9 to 21 samples, no replicates. |
| | Metric 7: | Exposure Scenario | High | Exposure source well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not provided, stats in Table 2, analytical summary in Table 1. |
| | Metric 9: | Quality Assurance | Medium | QA factors implied and summarize in Table 1. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited gaps and limitations reported. |
| **Overall Quality Determination** | | | **High** | |

**Study Citation:** Mortamais, M., Chevrier, C., Philippat, C., Petit, C., Calafat, A. M., Ye, X., Silva, M. J., Brambilla, C., Eijkemans, M. J., Charles, M. A., Cordier, S., Slama, R. (2012). Correcting for the influence of sampling conditions on biomarkers of exposure to phenols and phthalates: a 2-step standardization method based on regression residuals. Environmental Health 11(1):29.

**HERO ID:** 1597770

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | This paper is about sampling. Methods were well-characterized. They describe a 2-step standardization method to limit the impact of between-subject variations in sampling conditions. |
| | Metric 2: | Analytical Methodology | Medium | LODs would be found in the second SI file. Samples were sent to the National Center for Environmental Health laboratory at the Centers for Disease Control and Prevention in the US for analysis a few years after collection. Analytical methods are summarized. |
| | Metric 3: | Biomarker Selection | High | Metabolites were measured in urine. 4 metabolites of DEHP were summed. 7 other metabolites were reported individually. The metabolites of this chemical have a direct and known relationship with the parent chemical. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | France |
| | Metric 5: | Currency | Medium | 2002-2006 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 287 samples were collected, but no replicates. Urine samples were collected in the morning. |
| | Metric 7: | Exposure Scenario | Medium | Samples reflect amount of phthalate metabolites in urine of pregnant women in the vicinity of 3 cities in France. The questionnaire the women completed did not go into detail about potential sources of exposure to phthalates, but information such as whether the women smoked was collected. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Median values and the 25th and 75th percentiles were provided, but not means, ranges, or standard deviations. Raw data was not included. This article shows only a subset of the data collected. For more detailed results, see Chevrier C, Petit C, Philippat C, Mortamais M, Slama R, Rouget F, Calafat AM, Ye X, Silva MJ, Charles MA, et al: Maternal Urinary Phthalates and Phenols and Male Genital Anomalies. Epidemiology 2012, 23(2):353–356. |
| | Metric 9: | Quality Assurance | Low | QA was not discussed, but no obvious concerns came to mind during review. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Some limitations are discussed, e.g., possible factors not characterized that could have affected results. One data table provides information about the association between sampling conditions (time, season, gestational age, duration of sample storage at room temperature, etc.) and concentrations of log-transformed phthalate metabolites. These are the only elements pf the paper that address variability and uncertainty. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Liu, Y.,u, Chen, Z., Shen, J. (2013). Occurrence and Removal Characteristics of Phthalate Esters from Typical Water Sources in Northeast China. Journal of Analytical Methods in Chemistry 2013:419349. |
| **HERO ID:** | 1598198 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Described sampling site in detail. Sparse information on sample collection, equipment, and procedures. |
| | Metric 2: | Analytical Methodology | High | Detection limits were provided as a range from 6 to 30 ng/L. Extraction procedure followed EPA method. Extracted with GC and referenced other publications for more details. |
| | Metric 3: | Biomarker Selection | N/A | Tested for parent chemicals in water sources |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | 2008 and 2011 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 16 sampling sites. No replicates |
| | Metric 7: | Exposure Scenario | Medium | presence of phthalate esters in environment, specifically drinking water sources |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Reported mean, range, and detection frequency but not individual sample stats |
| | Metric 9: | Quality Assurance | Medium | used procedural blanks, describe sterilization procedure. Most mean recoveries >70%, but low end of some compounds were <70% |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Provide range and discuss variation BETWEEN different chemical concentrations at different sites but not variation within samples. Some discussion of limitations and data gaps |
| **Overall Quality Determination** | | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | Pei, X. Q., Song, M., Guo, M., Mo, F. F., Shen, X. Y. (2013). Concentration and risk assessment of phthalates present in indoor air from newly decorated apartments. Atmospheric Environment 68:17-23. |
| **HERO ID:** | 1598351 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling procedure, equipment, and transport were described. |
| | Metric 2: | Analytical Methodology | High | GC was used for analysis, LOD was reported for each chemical. |
| | Metric 3: | Biomarker Selection | N/A | NA - indoor air samples no biomarker needed. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | residential homes in Hangzhou, China |
| | Metric 5: | Currency | Medium | 2011-2012 |
| | Metric 6: | Spatial and Temporal Variability | High | 10 newly decorated apartments were sampled |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant exposure scenario (indoor air). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Average concentrations were reported with summary statistics. |
| | Metric 9: | Quality Assurance | High | QA/QC methods were described and recovery rates ranged from 91.75% to 115.1%. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study compared its results to other studies in other countries; discussion of variability and limitation is limited. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Zhang, Q.,i, Lu, X., Zhang, X. L., Sun, Y. G., Zhu, D., Wang, B. L., Zhao, R., Zhang, Z. D. (2013). Levels of phthalate esters in settled house dust from urban dwellings with young children in Nanjing, China. Atmospheric Environment 69:258-264. |
| **HERO ID:** | 1598628 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Brief description, more details in supplemental information. Sampling materials not included in main text, supplemental not available. |
| | Metric 2: | Analytical Methodology | Medium | Brief description, missing some details about the analytical setup |
| | Metric 3: | Biomarker Selection | N/A | NA - Dust sample no biomarker needed |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Nanjing, China |
| | Metric 5: | Currency | Medium | Data collected in 2011 |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicates collected |
| | Metric 7: | Exposure Scenario | High | Urban dwellings and behavior patterns |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | raw data not provided, missing outdoor dust |
| | Metric 9: | Quality Assurance | High | Analytical QA described and reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Sources of uncertainty and variability within the data discussed. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Maas, R. P., Patch, S. C., Pandolfo, T. J. (2004). Inhalation and ingestion of phthalate compounds from use of synthetic modeling clays. Bulletin of Environmental Contamination and Toxicology 73(2):227-234. |
| **HERO ID:** | 1598666 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling procedure, product fume emission measurement was described. |
| | Metric 2: | Analytical Methodology | Low | GC/MS was used to analyze the samples. LOD was not reported. |
| | Metric 3: | Biomarker Selection | N/A | Fumes and residues from modeling clay |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Thought not directly reported, the clay products were sold and used in the U.S. |
| | Metric 5: | Currency | Low | No sampling date is provided, but a publication date is available - 2004. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 10 samples were reported to be measured and analyzed |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant exposure scenario (children, inhalation, commercial products). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data were reported in Table 1 and 2 with no summary statistics. |
| | Metric 9: | Quality Assurance | Low | Quality assurance/quality control techniques and results were not directly discussed, but can be implied through the study's use of standard field and laboratory protocols. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | The study had little discussion of variability or limitation |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Otake, T., Yoshinaga, J., Yanagisawa, Y. (2001). Analysis of organic esters of plasticizer in indoor air by GC-MS and GC-FPD. Environmental Science & Technology 35(15):3099-3102. |
| **HERO ID:** | 1598712 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Samples were collected according to publicly available SOPs that are scientifically sound and widely accepted (i.e., from trusted or authoritative source) for the chemical and media of interest. |
| | Metric 2: | Analytical Methodology | High | Samples were analyzed according to publicly available analytical methods that are scientifically sound and widely accepted (i.e., from trusted or authoritative source) and are appropriate for the chemical and media of interest. |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Japan. |
| | Metric 5: | Currency | Low | Timing of sample collection for monitoring data is not reported, discussed, or referenced. However, publication year of 2001 is used as a proxy for sampling year. |
| | Metric 6: | Spatial and Temporal Variability | Medium | There were 5-10 samples collected for a single scenario. No replicates were reported. |
| | Metric 7: | Exposure Scenario | Low | The data somewhat represents relevant indoor air exposure scenarios. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. Summary statistics were included. |
| | Metric 9: | Quality Assurance | Medium | The study applied and documented quality assurance/quality control measures; however, one or more pieces of QA/QC information is not described. Missing information is unlikely to have a substantial impact on results. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Gaps and limitations not reported. There was only a minimal characterization of variability and uncertainty. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Cheng, Z., Nie, X. P., Wang, H. S., Wong, M. H. (2013). Risk assessments of human exposure to bioaccessible phthalate esters through market fish consumption. Environment International 57-58:75-80. |
| **HERO ID:** | 1600107 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling procedure was only briefly mentioned and lacked details. It is mentioned there is more information in S1 (not in HERO link for QCer). |
| | Metric 2: | Analytical Methodology | High | Analytical procedure -GCMS was described, along with LOQ. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Hong Kong |
| | Metric 5: | Currency | Medium | May-November 2009 |
| | Metric 6: | Spatial and Temporal Variability | High | 20 species of commonly consumed fish were sampled, varying with 3-36 replicates depending on the fish type (table 1) |
| | Metric 7: | Exposure Scenario | High | Exposure matrix was relevant - food/diet/aquatic species |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Data were reported as average and not individual samples. Some summary statistics provided. |
| | Metric 9: | Quality Assurance | High | QA/QC was performed. The target compounds have high recovery rates >73.1% and recoveries of internal standards in method blanks and in fish samples were >70% |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study compared the results to previous studies and other publications. No limitations provided. |

## Overall Quality Determination High

**Study Citation:** Langer, S., Bekö, G., Weschler, C. J., Brive, L. M., Toftum, J., Callesen, M., Clausen, G. (2014). Phthalate metabolites in urine samples from Danish children and correlations with phthalates in dust samples from their homes and daycare centers. International Journal of Hygiene and Environmental Health 217(1):78-87.

**HERO ID:** 1600114

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling procedure, equipment, matrix characters, calibration are clearly described and detailed description was provided in the main text. |
| | Metric 2: | Analytical Methodology | High | Analytical methods for both urinary concentrations (LC/MS) and dust concentrations (GC-MS) were provided. Detection limits were reported. (Dust concentrations provided in Langer et al., 2010 Table S1; HERO ID is 1007791. Urinary results presented in Table 1 of this study). Authors did not adjust for creatinine but explained why. |
| | Metric 3: | Biomarker Selection | Low | MnBP is a biomarker for both DBP and BBP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was performed in Odense, Denmark. |
| | Metric 5: | Currency | Medium | The dust samples and urinary samples were collected in 2008. |
| | Metric 6: | Spatial and Temporal Variability | Medium | The study has large sample size and can capture the variability of environmental contamination in population and scenario. There were no replicates, which might not be appropriate for a large study analyzing urine samples, but monitoring guide instructs that medium is the highest score if replicates are missing. |
| | Metric 7: | Exposure Scenario | High | The study explained the many possible sources of exposure to phthalates and their population of interest. This is a biomonitoring study to assess exposure to the chemicals. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Supplementary or raw data or individual data points are not reported. |
| | Metric 9: | Quality Assurance | High | Quality assurance was conducted for both dust concentration and urinary concentration. Recoveries for urinary concentrations were provided in this study. Recoveries for dust concentrations were reported in another study Langer et al 2010 (HERO ID: 1007791). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study has a robust characterization of variance with standard deviations for both the geometric and arithmetic means, as well as percentiles. There is some discussion of uncertainties, limitations, and gaps. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Shell Oil, (1986). Fate of some specific compounds in the Norco chemical biotreater and their effect on the outcome of effluent bioassays. |
| **HERO ID:** | 1629033 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | There is limited description included. It says water samples were daily composites, but there is little other information about water sampling protocol. Missing information includes sampling equipment for water, sampling procedures, sample storage, and performance/calibration of sampler. Page 35 explains in some detail sampling and analysis procedures for the vapor samples collected with TENAX traps, including calibration information. |
| | Metric 2: | Analytical Methodology | Medium | There is limited description included. They used GC/MS. MDLs listed for water samples, based on EPA published values. Analytical methodologies for water samples were EPA-approved. It appears standards were used, but their use is not well-explained. Recoveries are only mentioned for SVOCs. Spiking is only mentioned for the June 1984 samples. Although MDLs are not listed for air samples, p. 35 explains in some detail sampling and analysis procedures for the vapor samples collected with TENAX traps, including calibration information. Medium applies to water, the primary medium analyzed; low applies to air samples due to missing MDLs and generally limited information. |
| | Metric 3: | Biomarker Selection | N/A | Samples were from environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | USA |
| | Metric 5: | Currency | Low | Sampling began in 1984 |
| | Metric 6: | Spatial and Temporal Variability | Low | Sampling approach poorly captures variability of environmental contamination. Samples collected from 8 locations on June 11, 1984 (see p. 44) were analyzed for this chemical. For results, see pp. 49 and 51. However, there were no replicates/duplicates. |
| | Metric 7: | Exposure Scenario | Medium | Data may represent a relevant exposure scenario, but come from "pilot plants," with different aeration methods and temperatures to actual WWTPs. Data are missing details about the population of interest, the climate, and contextual information such as what types of manufacturing facilities the wastewater treated is coming from. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only individual sample concentrations are provided, no summary statistics. |
| | Metric 9: | Quality Assurance | Low | There was only one blank water sample, from June 1984. Spiking of a blank air sample for calibration is mentioned too. Recoveries are only discussed for samples analyzed for SVOCs but were from 11 to 38 percent. They did not correct for low recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability was not characterized, and there was minimal discussion of uncertainties. No standard deviations were reported. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Téllez-Rojo, M. M., Cantoral, A., Cantonwine, D. E., Schnaas, L., Peterson, K., Hu, H., Meeker, J. D. (2013). Prenatal urinary phthalate metabolites levels and neurodevelopment in children at two and three years of age. Science of the Total Environment 461-462:386–390. |
| **HERO ID:** | 1639217 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sample collection procedure was reported with details; standard method to measure human urinary concentration was used. |
| | Metric 2: | Analytical Methodology | High | Analytical process was reported. LOD for each metabolite was reported in Table 2. |
| | Metric 3: | Biomarker Selection | High | Biomarker (parent chemical or metabolite) is derived from exposure to the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Mexico City |
| | Metric 5: | Currency | Low | Samples were archived urine samples from 1997-2003 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Final sample consisted of 135 children. No indication of replicate sampling or analysis. |
| | Metric 7: | Exposure Scenario | High | Exposure matrix was highly relevant - metabolite of target chemicals. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Geometric mean were reported, no raw data were provided. |
| | Metric 9: | Quality Assurance | Medium | QA/QC was conducted but briefly discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | The study has a robust discussion of its limitations and comparisons to other publications. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Hongjun, Y., Wenjun, X., Qing, L., Jingtao, L., Hongwen, Y., Zhaohua, L. (2013). Distribution of phthalate esters in topsoil: a case study in the Yellow River Delta, China. Environmental Monitoring and Assessment 185(10):8489-8500. |
| **HERO ID:** | 1639226 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Yellow River Delta, China |
| | Metric 5: | Currency | Medium | Samples collected in September 2009 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | Medium | Soil samples in various locations, urban, suburban and rural. Unclear if is applicable to US soils |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported |
| | Metric 9: | Quality Assurance | High | QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Gaps and limitations not well characterized |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Sun, J., Huang, J., Zhang, A., Liu, W., Cheng, W. (2013). Occurrence of phthalate esters in sediments in Qiantang River, China and inference with urbanization and river flow regime. Journal of Hazardous Materials 248-249(1):142-149. |
| **HERO ID:** | 1639231 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported. See SI for detection limits |
| | Metric 3: | Biomarker Selection | N/A | Parent chemicals were tested in river sediment |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Qiantang River, China |
| | Metric 5: | Currency | Medium | Samples collected in 2011 |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure source characterized - unclear how population can be exposed to the river sediment (i.e., how do they use the river). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not provided |
| | Metric 9: | Quality Assurance | Medium | Key QA reported. Some recoveries were low if considering the reported range and not just the mean. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported. Variance characterized in SI (Table SM-3) |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Westinghouse Savannah River Company, (1997). Sanitary landfill groundwater monitoring report. Fourth quarter 1996 and 1996 summary. 14(GRA and I):506. |
| **HERO ID:** | 1740826 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some sampling methods not reported such as sample storage conditions and sampler calibration |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported |
| | Metric 3: | Biomarker Selection | N/A | the study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | USA |
| | Metric 5: | Currency | Low | Samples collected in 1996 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | High | Exposure source characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Raw data reported |
| | Metric 9: | Quality Assurance | High | Key QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Few gaps and limitations reported |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Westinghouse Savannah River Company, (1992). Sanitary Landfill 1991 annual groundwater monitoring report. |
| **HERO ID:** | 1740870 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling methodology is only briefly discussed, therefore, most sampling information is missing and likely to have a substantial impact on results. The type of monitoring wells are reported. |
| | Metric 2: | Analytical Methodology | Critically Deficient | Analytical methodology was not described, including analytical instrumentation. |
| | Metric 3: | Biomarker Selection | N/A | The study tested for the parent chemical in environmental media (groundwater). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The samples were collected in Savannah River Site, Aiken, SC. |
| | Metric 5: | Currency | Low | The samples were collected in 1991. |
| | Metric 6: | Spatial and Temporal Variability | Low | The collection of replicates was not reported. Fifty-seven wells were sampled, but sample size is not reported. It's inferred that at least one sample was collected from each well. |
| | Metric 7: | Exposure Scenario | Medium | Groundwater samples were collected from monitoring wells beneath a sanitary landfill. The use of exposure controls are not described. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Raw data is reported in tables for each monitoring well starting on page 168. Summary statistics are not reported. |
| | Metric 9: | Quality Assurance | Low | QA/QC techniques and results were not directly discussed and recoveries were not reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | The characterization of variability is absent (no measure of variance reported). Key uncertainties, limitations, and data gaps are not discussed. |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Geraghty & Miller Inc, (1983). Hydrogeology of the Hill Site: The Bendix corporation: Sidney, New York with cover letter. |
| **HERO ID:** | 1745520 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | There is some (limited) sampling methodology reported for soil collection on pg 62, but half of that page is illegible. Sampling methods for groundwater were almost nonexistent, as the report primarily focused on boring installation. |
| | Metric 2: | Analytical Methodology | High | Volatile organic compounds analyzed by EPA method 601. LODs are reported in Appendix E at the bottom of the table on page 81. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemicals were tested in soil and water. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sampling conducted at the Bendix Corporation plant in Sidney, New York. |
| | Metric 5: | Currency | Low | Samples collected in 1983. |
| | Metric 6: | Spatial and Temporal Variability | Low | Samples were collected from the wells five times as the drillings proceeded. There is no report of number of samples. Duplicate sampling occurred some but not all of the time. |
| | Metric 7: | Exposure Scenario | High | Soil and ground water were sampled to investigate the extent of contamination at this site. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Table 3 presents the results but due to the quality of the scan it is impossible to read. Appendix E contains the laboratory reports. |
| | Metric 9: | Quality Assurance | Low | The laboratory followed an EPA method so QA/QC can be inferred. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | There is no information on sample variability or statistics. The document reports the need to keep monitoring the next steps. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Geraghty & Miller Inc, (1988). Results of the second phase of a hydrogeologic investigation at the Allied-Signal Inc facility, Morristown, New Jersey with cover letter dated 012089. |
| **HERO ID:** | 1745619 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Critically Deficient | The study did not report storage conditions, sampling equipment or procedures. |
| | Metric 2: | Analytical Methodology | Low | The study did not describe analytical methods or reported LODs however it cited EPA Method 601. |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in an environmental media (water). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Geographic location is reported; New Jersey, USA. |
| | Metric 5: | Currency | Low | Timing of sample collection for monitoring data is not consistent with when current exposures (sampling occurred in 1987; >15 years old) may be expected and likely to have a substantial impact on results. |
| | Metric 6: | Spatial and Temporal Variability | Low | Sampling approach does not captures variability of environmental contamination in population/scenario/media of interest. The study used 20 samples and no replicates. |
| | Metric 7: | Exposure Scenario | Medium | The study did not provide details about the population of interest or exposure assessment. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual sample concentrations (raw data) reported but there is no summary statistics. |
| | Metric 9: | Quality Assurance | Medium | Limited description of QA/QC techniques. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Did not characterize variability, or discussed uncertainties and limitations. |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Dames & Moore, (1989). Ground water and soils data summary report with attachments, appendices, cover sheets and letter dated 080989. |
| **HERO ID:** | 1745621 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Limited description of sampling methodology |
| | Metric 2: | Analytical Methodology | Critically Deficient | Analytical methods not described |
| | Metric 3: | Biomarker Selection | N/A | Did not sample for biomarkers |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Illinois, USA |
| | Metric 5: | Currency | Low | Samples from 1987 |
| | Metric 6: | Spatial and Temporal Variability | Low | 5 samples, no replicates |
| | Metric 7: | Exposure Scenario | Medium | Data likely represents a relevant exposure scenario, missing details about the population of interest and microenvironment |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only individual sample concentrations, no summary statistics |
| | Metric 9: | Quality Assurance | Medium | Limited description of QA/QC techniques, analyzed control samples |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and uncertainty were not characterized or described |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Kong, S., Ji, Y., Liu, L., Chen, L.,i, Zhao, X., Wang, J., Bai, Z., Sun, Z. (2013). Spatial and temporal variation of phthalic acid esters (PAEs) in atmospheric PM10 and PM2.5 and the influence of ambient temperature in Tianjin, China. Atmospheric Environment 74:199-208. |
| **HERO ID:** | 1935999 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology described in detail in terms of sampling equipment, procedures, storage conditions, calibration of sampler, study site (urban residential/industrial, season, temperature) and matrix (ambient air) characteristics (height of samplers, distance from road). Insufficient information regarding duration of storage of samples prior to analyses. |
| | Metric 2: | Analytical Methodology | High | High: Analytical methodology described in detail in terms of extraction method, analytical instrumentation, instrument calibration, chemical-specific limits of detection, recoveries. |
| | Metric 3: | Biomarker Selection | N/A | Not applicable: no biomonitoring conducted. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sampling conducted in Tianjin, China. |
| | Metric 5: | Currency | Medium | Sampling conducted in winter, summer, and spring of 2010. |
| | Metric 6: | Spatial and Temporal Variability | High | Spatial variability in terms of seven sampling locations described as across urban functional (residential, industrial, traffic, commercial) zones with height of sampler placement specified; relatively large sample size of n=21 PM10 at each of seven sampling sites and n=15 PM2.5 samples collected at each of three sampling sites (replicate sampling). Temporal variability described for 24-hour sampling conducted across winter, spring and summer of 2010. |
| | Metric 7: | Exposure Scenario | High | Exposure scenario described for sampling results in terms of residential, traffic, residential/commercial, residential/traffic, and industrial functional areas. Use of field blanks described. Concentrations by microenvironment in terms of season and temperature reported. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics reported as mean and standard deviation of concentration results across location and dates of sampling with numbers of samples, frequency of detection specified. Insufficient information on raw data results. |
| | Metric 9: | Quality Assurance | Medium | Quality assurance procedures outlined in detail in terms of use of cleaning of sampling equipment within a clean laboratory, calibration of samplers, baking of filters to remove organic compounds prior to sampling, use of field blanks and blank-correction of concentration results. Pre-exposure sampling not conducted. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability in terms of reported concentration standard deviations, as well as concentration results across variable locations, seasons, temperatures, specified. Authors discussed and analyzed potential sources of exposure concentrations, as well as differences between reported concentrations within this study and others, however insufficient robust discussion of potential study limitations, uncertainties and data gaps. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Dirtu, A. C., Geens, T., Dirinck, E., Malarvannan, G., Neels, H., Van Gaal, L., Jorens, P. G., Covaci, A. (2013). Phthalate metabolites in obese individuals undergoing weight loss: Urinary levels and estimation of the phthalates daily intake. Environment International 59(Elsevier):344–353. |
| **HERO ID:** | 1936010 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | ENDORUP trial described, 24-hour urine at 4 timepoints described. Some information missing such as sampling equipment and storage. |
| | Metric 2: | Analytical Methodology | High | LOQ in Table SI.3. Equipment and extraction described. Calibration described in SI. Creatinine adjusted. |
| | Metric 3: | Biomarker Selection | High | Metabolite in urine. The study indicates that the metabolites are from the parent chemicals of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Belgium |
| | Metric 5: | Currency | Medium | 2009-2012 |
| | Metric 6: | Spatial and Temporal Variability | High | 152 participants, 24-hour urine samples. Blind sample duplicates (at least 2 blind duplicate samples per batch of 20 samples) |
| | Metric 7: | Exposure Scenario | High | Biomonitoring in humans, more specifically obese individuals. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics provided, including median, 10th, 90th, 25th, 75th. Individual points not reported. |
| | Metric 9: | Quality Assurance | High | LOQ, spike level, recovery, method precision, blind duplicate samples, internal blanks described; also participated in inter-laboratory comparison exercise GERMAN EQUAS 2012. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability discussed and compared to other studies. No limitations reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Upson, K., Sathyanarayana, S., De Roos, A. J., Thompson, M. L., Scholes, D., Dills, R., Holt, V. L. (2013). Phthalates and risk of endometriosis. Environmental Research 126:91-97. |
| **HERO ID:** | 1936011 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | WREN study enrollment described and refers to other papers; Non-fasting spot urine samples. Sampling containers described and storage conditions described. |
| | Metric 2: | Analytical Methodology | High | LOQ, extraction, and equipment described |
| | Metric 3: | Biomarker Selection | High | metabolite in urine |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | U.S. |
| | Metric 5: | Currency | Low | 1996-2001 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 92 cases and n = 195 controls, no replicates |
| | Metric 7: | Exposure Scenario | High | urine |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | median and IQR provided |
| | Metric 9: | Quality Assurance | High | quality process described; inter batch reliability reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | variability and uncertainty not discussed, no obvious concerns. limitations discussed |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Orecchio, S., Indelicato, R., Barreca, S. (2013). The distribution of phthalate esters in indoor dust of Palermo (Italy). Environmental Geochemistry and Health 35(5):613-624. |
| **HERO ID:** | 1936014 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methods reference European Standard EN12341 but does not detail sampler calibration, filter handling, or equipment for dust collection and whether is was cleaned prior. |
| | Metric 2: | Analytical Methodology | High | Extraction and GC/MS method described. Limit of detection and limit of quantification generally reported. |
| | Metric 3: | Biomarker Selection | N/A | air sampling |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Palermo, Italy |
| | Metric 5: | Currency | Medium | Study conducted in 2013 |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicate samples collected |
| | Metric 7: | Exposure Scenario | High | Exposure from indoor air characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | no raw data provided |
| | Metric 9: | Quality Assurance | High | Recovery experiments used for correction, blank analysis, and replicate analysis to test precision of method were conducted |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability in results discussed. Limitations of study itself not well described |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Yoshida, T., Matsunaga, I., Tomioka, K., Kumagai, S. (2006). Interior air pollution in automotive cabins by volatile organic compounds diffusing from interior materials: I. Survey of 101 types of Japanese domestically produced cars for private use. Indoor and Built Environment 15(5):425-444. |
| **HERO ID:** | 1949033 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | A detailed description of the sampling methodology is provided. |
| | Metric 2: | Analytical Methodology | Low | The description of the analytical methodology provided has a few flaws. |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in Japan. |
| | Metric 5: | Currency | Low | The study was conducted in the summer season (June–September) of 2001 (n=14), 2002 (n=28), 2003 (n=47) or 2004 (n=12). |
| | Metric 6: | Spatial and Temporal Variability | High | There were $\geq$ 10 samples for a single scenario. |
| | Metric 7: | Exposure Scenario | High | The exposure scenario discussed in the monitored study represents the exposure scenario of interest for the chemical. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | The presentation of results was good. |
| | Metric 9: | Quality Assurance | Low | The description of QA/QC was poor. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The presentation of variability and uncertainty was good. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Lewis, R. C., Meeker, J. D., Peterson, K. E., Lee, J. M., Pace, G. G., Cantoral, A., Téllez-Rojo, M. M. (2013). Predictors of urinary bisphenol A and phthalate metabolite concentrations in Mexican children. Chemosphere 93(10):2390-2398. |
| **HERO ID:** | 2000737 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | ELEMENT cohort described; urine sampling not described in detail. |
| | Metric 2: | Analytical Methodology | Medium | An in-house method was developed, which was a slight modification of the CDC Laboratory Procedure Manuals for phthalate metabolites in urine (method no. 6306.03, revised: July 3, 2010) - modification not described; LOQ provided |
| | Metric 3: | Biomarker Selection | High | The study is looking at parent chemical/metabolites in urine. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted among children/mothers in Mexico. |
| | Metric 5: | Currency | Medium | Timing of sample collection for monitoring data is less consistent with current or recent exposures may be expected (.5 yrs). Sampling period was from 2010. However some prior data from a 1994 cohort study was also used. |
| | Metric 6: | Spatial and Temporal Variability | Low | The study used a large sample size (n = 49 boys and 50 girls). However, urine sampling not described well enough (the study is not clear if urine samples were 24 hrs samples collected vs. first morning). |
| | Metric 7: | Exposure Scenario | High | Biomonitoring to quantify the exposure from Mexican boys and girls from the ELEMENT cohort. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Supplementary or raw data (i.e., individual data points) are not reported , and therefore summary statistics cannot be reproduced.Geometric mean, 10th, 25th, 50th, 75th, 90th, 95th, max provided. |
| | Metric 9: | Quality Assurance | Low | Quality control samples mentioned. However, no other details provided. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability reported as percentiles. Some uncertainties have been identified, but are unlikely to have a substantial impact on results. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Kim, M., Song, N. R., Choi, J. H., Lee, J., Pyo, H. (2014). Simultaneous analysis of urinary phthalate metabolites of residents in Korea using isotope dilution gas chromatography-mass spectrometry. Science of the Total Environment 470-471:1408-1413. |
| **HERO ID:** | 2000812 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Critically Deficient | The sampling methodology is not discussed. The only information that is given is "Twelve-hour urine samples were collected by the Korea Food and Drug Administration (KFDA) through local health departments on May 2011. One hundred eleven samples were collected from adults in urban (Seoul) and rural (Chuncheon) regions" |
| | Metric 2: | Analytical Methodology | Medium | LOD; some extraction and equipment description |
| | Metric 3: | Biomarker Selection | High | metabolite in urine |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Korea |
| | Metric 5: | Currency | Medium | 2011 |
| | Metric 6: | Spatial and Temporal Variability | Low | n = 5, no replicates, urine sampling not described |
| | Metric 7: | Exposure Scenario | Low | urine |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | mean, range, and frequency |
| | Metric 9: | Quality Assurance | Medium | recovery and precision discussed |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Chen, C., Chen, C. F., Dong, C. D. (2013). Distribution of phthalate esters in sediments of Kaohsiung Harbor, Taiwan. Soil and Sediment Contamination 22(2):119-131. |
| **HERO ID:** | 2002284 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Key sampling methods reported. No details on how sampling equipment was cleaned prior to sampling. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported. LOD range reported |
| | Metric 3: | Biomarker Selection | N/A | Sediment sampling |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Taiwan |
| | Metric 5: | Currency | Medium | Samples collected in 2006 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no indication of replicate sampling or analysis |
| | Metric 7: | Exposure Scenario | High | Exposure source characterized. Harbor with likely wastewater discharge |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not provided |
| | Metric 9: | Quality Assurance | Medium | Key QA reported. Recovery not based on chemicals of interest. Precision assessed but nor reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited gaps and limitations reported |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Dames & Moore, (1988). Report of hydrogeologic and environmental assessment for sixteen chemicals at the former Allied Automotive Plant with cover letter dated 033188. |
| **HERO ID:** | 2048351 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Samples were collected according to publicly available SOPs that are scientifically sound and widely accepted. VOCs were collected according to EPA Analytical Methods 601 and 602. Base/neutral extractable organic compounds were collected according to EPA Analytical Method 625 for groundwater and Method 8270 for soil. Sampling methodology described in section 1.1, groundwater sampling methods in section 1.1.2, and soil in section 1.1.3. |
| | Metric 2: | Analytical Methodology | High | Samples were analyzed according to publicly available analytical methods. VOCs were analyzed according to EPA Analytical Methods 601 and 602. Base/neutral extractable organic compounds were analyzed according to EPA Analytical Method 625 for groundwater and Method 8270 for soil. The detection level used is specified in the standard methods, but the values are listed in the report. |
| | Metric 3: | Biomarker Selection | N/A | The study tested for the parent chemical in environmental media (groundwater and soil). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The samples were collected in Port Huron, Michigan. |
| | Metric 5: | Currency | Low | The samples were collected in 1987. |
| | Metric 6: | Spatial and Temporal Variability | Medium | The collection of replicates was not reported. Composite soil samples were collected from five sites at three different depths. One sample was collected from three different monitoring wells. |
| | Metric 7: | Exposure Scenario | Medium | Groundwater and soil samples were collected from monitoring wells and the land on the site of a former automotive plant with previous contamination. The use of exposure controls are not described. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data is reported in Appendix C for groundwater and Appendix D for soil samples. Summary statistics are not reported. |
| | Metric 9: | Quality Assurance | Low | The study applied QA/QC measures like preventing cross contamination while collecting samples; however, recoveries and baseline samples are not reported. It's implied that QA/QC techniques were used through the study's use of standard field and laboratory protocols. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | The characterization of variability is absent (no measure of variance reported). Key uncertainties, limitations, and data gaps are not discussed. |

## Overall Quality Determination Medium

**Study Citation:** Teil, M. J., Tlili, K., Blanchard, M., Labadie, P., Alliot, F., Chevreuil, M. (2014). Polychlorinated biphenyls, polybrominated diphenyl ethers, and phthalates in roach from the Seine River Basin (France): Impact of densely urbanized areas. Archives of Environmental Contamination and Toxicology 66(1):41-57.

**HERO ID:** 2149497

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sample methods and location described. Insufficient information on some parameters such as sampling equipment and storage conditions. |
| | Metric 2: | Analytical Methodology | High | Extract, analytical instruments, detection limits, and recovery were described. |
| | Metric 3: | Biomarker Selection | N/A | Study tested parent chemical |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | France |
| | Metric 5: | Currency | Low | Text does not include sampling date, but might be able to infer that sampling occurred around 2010 based on Figure 1. However, that date can correspond to when the map was created and not actual sampling date. Paper was published in 2014 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 15 sites with sample sizes 2 to 12. No replicates |
| | Metric 7: | Exposure Scenario | High | Scenario is relevant to aquatic organisms and anyone who consumes or accesses the Orge and Seine Rivers basins |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | mean and SD Table 4. No raw data. |
| | Metric 9: | Quality Assurance | Medium | Quality not discussed except for recoveries, which were acceptable |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No discussion of uncertainties, gaps, or limitations. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Shen, L., Xia, B., Dai, X. (2013). Residues of persistent organic pollutants in frequently-consumed vegetables and assessment of human health risk based on consumption of vegetables in Huizhou, South China. Chemosphere 93(10):2254-2263. |
| **HERO ID:** | 2149595 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methods described. |
| | Metric 2: | Analytical Methodology | Low | LOD not reported and missing QA/QC. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Low | Sampling date not reported, published in 2013. |
| | Metric 6: | Spatial and Temporal Variability | High | 17 types of vegetables each with >10 samples. |
| | Metric 7: | Exposure Scenario | Medium | Consumption of vegetables and questionnaire. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Critically Deficient | No specific chemical concentrations reported. |
| | Metric 9: | Quality Assurance | Low | Missing QA/QC discussion, included calibration range. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Discussed distribution and differences between women and men and other studies. |

## Overall Quality Determination — Uninformative

| | |
|---|---|
| **Study Citation:** | Sánchez-Avila, J., Vicente, J., Echavarri-Erasun, B., Porte, C., Tauler, R., Lacorte, S. (2013). Sources, fluxes and risk of organic micropollutants to the Cantabrian Sea (Spain). Marine Pollution Bulletin 72(1):119-132. |
| **HERO ID:** | 2149885 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Location, matrix, and sampling method were described. Transplanted mussels were used. |
| | Metric 2: | Analytical Methodology | Low | Authors described overall analytical procedures and equipment. They cited another study for further details, including method limits. |
| | Metric 3: | Biomarker Selection | N/A | The study tested for the parent chemical in surface water. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in Spain. |
| | Metric 5: | Currency | Medium | Samples were collected in 2009. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Table 3 may indicate that only 1-3 samples were collected for each location. However, a closer read will reveal that the authors had multiple categories and sub categories within each one. Sub categories can be grouped together into groups A and B, as defined by the authors. For that reason, each group has 9-12 samples which qualifies for medium. Replicate samples were not collected. |
| | Metric 7: | Exposure Scenario | Medium | Surface waters and WWTP effluent were tested, and data indicate pollutants to the sea. Aquatic organisms is presumably the exposed population, but further characterization of the exposure scenario is needed. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Tables 3 and 4 provided means if there are multiple samples and raw data if there are single samples, so raw data are incomplete. Standard deviations provided in Table 3. |
| | Metric 9: | Quality Assurance | Low | QA/QC was not discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variance is characterized with standard deviations in Table 3. However, there is no discussion of uncertainty, gaps, or limitations. |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | Sánchez-Avila, J., Tauler, R., Lacorte, S. (2012). Organic micropollutants in coastal waters from NW Mediterranean Sea: Sources distribution and potential risk. Environment International 46:50-62. |
| **HERO ID:** | 2150619 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | surface waters and WWTP effluent sampled (Table 1); 1L glass bottles; stored at 4C and extracted within 48h; for river and port water, bottles placed in a drag; grab seawater for coastal and river mouths via expert swimmer 50-100m from coast and 1-2m deep; WWTP samples were 24h composite aliquots from effluent; unfiltered water samples |
| | Metric 2: | Analytical Methodology | Medium | SPE; GC/MS; MDL and recovery yields are described in Sánchez-Avila et al. (2011). |
| | Metric 3: | Biomarker Selection | N/A | NA - Coastal water samples no biomarker needed. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | NW Mediterranean sea (Catalan coast), Spain |
| | Metric 5: | Currency | Medium | March-July 2009 |
| | Metric 6: | Spatial and Temporal Variability | High | 46 seawater sampling sites (Table 1) - 22 coastal waters, 7 river mouth, 17 port, and 6 rivers; 8 sampling locations for WWTP effluent; sampling took place from spring to summer |
| | Metric 7: | Exposure Scenario | High | concentration is surface water (NW Mediterranean sea) which receives discharge from rivers and WWTP effluents; characteristics of each sampling location provided in Table 1 |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 2 provides DF, concentration range, and mean by sampling site type; individual sample concentrations not provided |
| | Metric 9: | Quality Assurance | Medium | recovery yields are described in Sánchez-Avila et al. (2011) |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | compared findings to other studies |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Almqvist, H., Hanaeus, J. (2006). Organic hazardous substances in graywater from Swedish households. Journal of Environmental Engineering 132(8):901-908. |
| **HERO ID:** | 2151800 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | site description and sampling described |
| | Metric 2: | Analytical Methodology | Low | Accredited contract laboratory conducted analyses, no LOD |
| | Metric 3: | Biomarker Selection | N/A | environmental samples |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sweden |
| | Metric 5: | Currency | Low | 2001 |
| | Metric 6: | Spatial and Temporal Variability | Low | n = 3 |
| | Metric 7: | Exposure Scenario | Low | graywater |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | range and average provided |
| | Metric 9: | Quality Assurance | Low | QA not discussed, no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Mackintosh, C. E., Maldonado, J. A., Ikonomou, M. G., Gobas, F. A. (2006). Sorption of phthalate esters and PCBs in a marine ecosystem. Environmental Science & Technology 40(11):3481-3488. |
| **HERO ID:** | 2158899 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Well described, scientifically sound methodology |
| | Metric 2: | Analytical Methodology | High | Thorough description, reports LODs. Values in Supporting Information. |
| | Metric 3: | Biomarker Selection | N/A | Water and sediment sample |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Canada |
| | Metric 5: | Currency | Low | Published in 2006. no sampling date |
| | Metric 6: | Spatial and Temporal Variability | Medium | 4 sampling locations with replicates for total of 12 water samples in total, 17 sediment samples in total |
| | Metric 7: | Exposure Scenario | High | describes sampling location as former industrial site that now hosts public market, docks, public entertainment venue. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Does not report raw data, only summary statistics |
| | Metric 9: | Quality Assurance | High | Used control samples, reported recoveries |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited discussion on key uncertainties and limitations |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Diaz-Torres, E., Gibson, R., Gonzalez-Farias, F., Zarco-Arista, A. E., Mazari-Hiriart, M. (2013). Endocrine Disruptors in the Xochimilco Wetland, Mexico City. Water, Air, and Soil Pollution 224(6):11-Jan. |
| **HERO ID:** | 2159828 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported |
| | Metric 2: | Analytical Methodology | Medium | Recovery samples not reported |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Mexico City |
| | Metric 5: | Currency | Medium | Samples collected in 2008 and 2009 |
| | Metric 6: | Spatial and Temporal Variability | High | >10 samples; samples collected in triplicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure scenario not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported |
| | Metric 9: | Quality Assurance | Low | Limited QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Wang, I. J., Lin, C. C., Lin, Y. J., Hsieh, W. S., Chen, P. C. (2014). Early life phthalate exposure and atopic disorders in children: A prospective birth cohort study. Environment International 62(Elsevier):48-54. |
| **HERO ID:** | 2215403 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling equipment/container not reported. |
| | Metric 2: | Analytical Methodology | High | Analytical methods, equipment (UPLC–MS/MS), LOD reported. |
| | Metric 3: | Biomarker Selection | High | Metabolite derived from parent chemical: monobenzyl phthalate (MBzP) |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Taiwan |
| | Metric 5: | Currency | Low | Samples collected in 2004 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 483 total samples. Pregnancy (N = 161) Age 2 (N = 218) Age 5 (N = 191). No replicates. |
| | Metric 7: | Exposure Scenario | High | Measuring phthalate exposure to pregnant women and children. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Raw data not reported. Only geometric means and correlations between ages reported. |
| | Metric 9: | Quality Assurance | Medium | Recoveries of phthalate metabolites spiked into artificial urine ranged from 93% to 102%. No blanks reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | The study mentions there are some potential limitations to this study and results should be cautiously interpreted. Geometric mean and standard errors reported for different subject demographics and factors. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Cantonwine, D. E., Cordero, J. F., Rivera-González, L. O., Anzalota Del Toro, L. V., Ferguson, K. K., Mukherjee, B., Calafat, A. M., Crespo, N., Jiménez-Vélez, B., Padilla, I. Y., Alshawabkeh, A. N., Meeker, J. D. (2014). Urinary phthalate metabolite concentrations among pregnant women in Northern Puerto Rico: Distribution, temporal variability, and predictors. Environment International 62:11-Jan. |
| **HERO ID:** | 2215404 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sample collection conducted according to CDC protocols developed for NHANES. |
| | Metric 2: | Analytical Methodology | Low | Processing procedures conducted according to CDC protocols developed for NHANES; LODs in the "low ng/ml range". |
| | Metric 3: | Biomarker Selection | High | Metabolite in urine. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Puerto Rico. |
| | Metric 5: | Currency | Medium | 2010-2012. |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 139; up to 3 samples per woman; spot urine samples, no replicates. |
| | Metric 7: | Exposure Scenario | High | Biomonitoring. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | GM, 25th, 50th, 75th, 95th, max provided. |
| | Metric 9: | Quality Assurance | Medium | To monitor for accuracy and precision, each analytical run included calibration standards, reagent blanks, and quality control materials of high and low concentrations. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Assessed between- and within-person variability (i.e., temporal reliability) in urinary metabolite concentrations. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Fromme, H., Lahrz, T., Kraft, M., Fembacher, L., Dietrich, S., Sievering, S., Burghardt, R., Schuster, R., Bolte, G., Völkel, W. (2013). Phthalates in German daycare centers: Occurrence in air and dust and the excretion of their metabolites by children (LUPE 3). Environment International 61:64-72. |
| **HERO ID:** | 2215411 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology provided and described. Indoor air samples were collected once on a glass fiber filter and additionallyon polyurethane foam using a GGP sampler which allows a standardized particle collection on filters and the adsorption of volatile phthalates to downstream PU foam. Dust sampling was conducted by slowly vacuuming the floor for approximately 5 to 10 min using an ALK dust filter holder connected to a vacuum cleaner. |
| | Metric 2: | Analytical Methodology | Medium | Some analytical methods not reported, such as recovery samples. |
| | Metric 3: | Biomarker Selection | High | List of metabolites and parent chemical in Table 1. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Germany. |
| | Metric 5: | Currency | Medium | Data collected in 2012. |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicates collected. |
| | Metric 7: | Exposure Scenario | High | Children in daycare centers, before and after metabolites and indoor air and particulate characterization. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not provided. |
| | Metric 9: | Quality Assurance | Medium | QA/QC implied, some info available in supplemental. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Liu, X., Shi, J., Bo, T., Zhang, H., Wu, W., Chen, Q., Zhan, X. (2014). Occurrence of phthalic acid esters in source waters: A nationwide survey in China during the period of 2009-2012. Environmental Pollution 184:262-270. |
| **HERO ID:** | 2215414 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | groundwater and surface water (river, reservoir and lake) used for drinking water sampled across seven regions of China (Fig 1); sampled during two campaigns (specific sampling period for each site in Table S1); collected in glass bottles, cooled at 4C and analyzed immediately at lab; water filtered; sampling equipment or how specifically collected not discussed |
| | Metric 2: | Analytical Methodology | High | SPE; GC-MS; recoveries; MDLs provided in Table S6 |
| | Metric 3: | Biomarker Selection | N/A | NA - water samples no biomarker needed |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | 7 geographic zones in China: Northwest China (Heilongjiang Province, Jilin Province, Liaoning Province and eastern region of Inner Mongolia); North China (Beijing City, Tianjin City, Hebei Province, Shanxi Province and the western region of Inner Mongolia); Northwest China (Shǎnxi Province, Gansu Province, Qinghai Province, Ningxia Hui Autonomous Region andXinjiang Uygur Autonomous Region; Southwest China (ChongqingCity, Sichuan Province, Yunnan Province, Guizhou Province and Tibet Autonomous Region; South China (Guangdong Province, Guangxi Province and Hainan Province; East China (Shanghai City, Jiangsu Province, Zhejiang Province, Fujian Province, Shandong Province, Anhui Province and Jiangxi Province; Central China (Henan Province, Hubei Province and Hunan Province) |
| | Metric 5: | Currency | Medium | December 2009 - May 2012 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 152 water sample (18 gw, 64 river, 70 lake and reservoir) during 2 sampling campaigns (80 from December 2009-March 2011 and others from Aug 2011 to May 2012). No replicates |
| | Metric 7: | Exposure Scenario | High | contamination in ground water and surface water that are sources of drinking water |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 1 provides summary of DF, max, median, IQR of total concentration in all the waters; raw data not provided |
| | Metric 9: | Quality Assurance | High | recoveries provided in Table S6; blank and duplicate samples; corrected for contamination (p264) |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | compared results to previous studies from other countries; compared results between various types of water sources, the 7 geographical zones, and the 7 major river basins |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Stewart, M., Olsen, G., Hickey, C. W., Ferreira, B., Jelić, A., Petrović, M., Barcelo, D. (2014). A survey of emerging contaminants in the estuarine receiving environment around Auckland, New Zealand. Science of the Total Environment 468-469:202-210. |
| **HERO ID:** | 2215424 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling approach described (grab samples) and sites also described. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Auckland, New Zealand |
| | Metric 5: | Currency | Medium | Samples collected in 2008 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples |
| | Metric 7: | Exposure Scenario | Medium | Estuarine environment. Description of sites provided, outdoor environment could be used for gen pop, environmental and certain animals and plants that live in these environments |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not provided |
| | Metric 9: | Quality Assurance | High | Key QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Gaps and limitations not well characterized |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Bamai, Y. A., Araki, A., Kawai, T., Tsuboi, T., Saito, I., Yoshioka, E., Kanazawa, A., Tajima, S., Shi, C., Tamakoshi, A., Kishi, R. (2014). Associations of phthalate concentrations in floor dust and multi-surface dust with the interior materials in Japanese dwellings. Science of the Total Environment 468-469:147-157. |
| **HERO ID:** | 2215426 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Briefly described, more information found in Kanazawa et al 2010. Missing description on materials used and contamination prevention. |
| | Metric 2: | Analytical Methodology | Medium | Briefly described, more information found in Kanazawa et al 2010. LOD provided and other details, but missing QA/QC description, recoveries |
| | Metric 3: | Biomarker Selection | N/A | NA - Dust samples biomarker not needed. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sapporo, Japan |
| | Metric 5: | Currency | Medium | 2009-2010 |
| | Metric 6: | Spatial and Temporal Variability | High | 128 samples |
| | Metric 7: | Exposure Scenario | High | Children dwelling patterns and exposure to dust. Unclear if scenario will apply to US children. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 3 Stats only |
| | Metric 9: | Quality Assurance | Low | Not well described, briefly mentioned, not reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability and uncertainty for the studies goal are well described, sampling uncertainty could be better described to fully trust results and conclusions |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Berman, T., Goldsmith, R., Göen, T., Spungen, J., Novack, L., Levine, H., Amitai, Y., Shohat, T., Grotto, I. (2013). Urinary concentrations of environmental contaminants and phytoestrogens in adults in Israel. Environment International 59:478-484. |
| **HERO ID:** | 2215430 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | recruiting and enrollment described, urine sampling described |
| | Metric 2: | Analytical Methodology | High | LOD and LOQ in Table 2, LC–MS/MS method - Göen et al., 2011 |
| | Metric 3: | Biomarker Selection | High | metabolite in urine |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Israel |
| | Metric 5: | Currency | Medium | 2011 |
| | Metric 6: | Spatial and Temporal Variability | Medium | urine spot samples, n = 248. no replicates |
| | Metric 7: | Exposure Scenario | High | urine |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | GM, 50th and 90th provided |
| | Metric 9: | Quality Assurance | Medium | Quality control of the chemical analyses was performed by the determination of control samples in each series and assessment of the results in control charts for each parameter (internal quality control); German External Quality Assessment Scheme (Göen et al., 2012). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | variability discussed |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Hu, X., Shi, W., Wei, S., Zhang, X., Feng, J., Hu, G., Chen, S., Giesy, J. P., Yu, H. (2013). Occurrence and potential causes of androgenic activities in source and drinking water in China. Environmental Science & Technology 47(18):10591-10600. |
| **HERO ID:** | 2215435 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling locations identified. Sampling methods on how water was collected not detailed. Preparation of sampling bottles not included and storage conditions after sampling not described. |
| | Metric 2: | Analytical Methodology | High | GC-MS/MS and LC-MS used for analysis. Mean recoveries and LOQs given in supplemental information. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Yangtze River Basin, Huai River Basin, Tai Lake Basin, andgroundwater in eastern China |
| | Metric 5: | Currency | Medium | Samples collected in August 2009 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Raw data reported in the manuscript |
| | Metric 9: | Quality Assurance | High | Key QA/QC conducted and details reported in supplement. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited gaps and limitations reported |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Shin, H. M., Mckone, T. E., Nishioka, M. G., Fallin, M. D., Croen, L. A., Hertz-Picciotto, I., Newschaffer, C. J., Bennett, D. H. (2014). Determining source strength of semivolatile organic compounds using measured concentrations in indoor dust. Indoor Air 24(3):260-271. |
| **HERO ID:** | 2215665 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | The sampling method was discussed in detail, including sampling procedure, storage conditions, and matrix characterization. Information regarding duration of sample storage prior to analysis was lacking. |
| | Metric 2: | Analytical Methodology | High | The analytical method (GC/MS) was described in terms of instrumentation, extraction, calibration, and recovery, with limits of detection reported within Table S1. |
| | Metric 3: | Biomarker Selection | N/A | This study sampled for chemicals of interest within indoor dust. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected from residences in Northern California, Southeast Pennsylvania, and Northeast Maryland. |
| | Metric 5: | Currency | Medium | Samples were collected during 2009 and 2010. |
| | Metric 6: | Spatial and Temporal Variability | Medium | A total of 30 indoor surface dust samples, one from a single main living room of each house, were collected in an area described as the equivalent of the entire floor surface area of participating homes within Northern California, Southeast Pennsylvania, and Northeast Maryland between 2009 and 2010. Replicate sampling was not detailed. |
| | Metric 7: | Exposure Scenario | High | The exposure scenario was described and was highly relevant (indoor air) and the study used fugacity-based modeling to predict the emission, fate and movement of chemicals in the indoor environment from various consumer product exposure sources. Use of exposure controls was not detailed. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No individual raw data points were provided. Statistical summary measures included mean, standard deviation, median and maximum concentrations as well as frequency of detection in Table S1. |
| | Metric 9: | Quality Assurance | Medium | Quality assurance measures were applied and described in robust details. Solvent method blanks were used and recoveries were reported. Baseline, pre-exposure sampling was not conducted. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | The study had a robust discussion of uncertainty and compared results to results of other studies. The study also characterized limitations in details. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | He, W., Qin, N., Kong, X. Z., Liu, W. X., He, Q. S., Wang, Q. M., Yang, C., Jiang, Y. J., Yang, B., Wu, W. J., Xu, F. L. (2014). Water quality benchmarking (WQB) and priority control screening (PCS) of persistent toxic substances (PTSs) in China: Necessity, method and a case study. Science of the Total Environment 472:1108-1120. |
| **HERO ID:** | 2219809 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology included a site characterization, maps of collection points in Figure S1, and amount of water collected. There was no information, however, on the equipment used, storage conditions, etc. |
| | Metric 2: | Analytical Methodology | High | The SI described a detailed and scientifically sound analytical methodology in the SI and included LODs and recoveries in Table S1. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in surface water. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was performed in eastern China. |
| | Metric 5: | Currency | Medium | Samples were collected in 2010-2011. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Authors collected 12 monthly samples at 4 sampling sites but no replicates. |
| | Metric 7: | Exposure Scenario | High | The pollution levels can have implications for the lake's aquatic life and local residents who use it. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual sample concentration data were not provided. |
| | Metric 9: | Quality Assurance | Medium | Recoveries were acceptable, but overall there is limited information regarding laboratory and field controls. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The discussion of uncertainties and study limitations was limited. There was some characterization of variance in Table S2 with percentiles. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | HEW, (2013). Spatio-temporal distributions and the ecological and health risks of phthalate esters (PAEs) in the surface water of a large, shallow Chinese lake. Science of the Total Environment 461:672-680. |
| **HERO ID:** | 2219885 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Detailed sampling methodology, equipment, and storage. Missing equipment calibration. |
| | Metric 2: | Analytical Methodology | High | Analytical extraction, methods, recoveries, equipment calibration, and equipment (GC-MS) described. Quantitation limits reported. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | 2010-2011 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 44 samples from 3-4 sites over the course of a year. Unclear if there are replicates. |
| | Metric 7: | Exposure Scenario | High | Water from lakes that could be exposed to the population. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics (mean, median, SD, range). No individual data reported. |
| | Metric 9: | Quality Assurance | Medium | Detailed QA/QC, analyzed control samples. Three to four parallel samples with three procedural blanks were processed for each monthly sampling site. Some recoveries below 70%. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Temporal and spatial variability discussed. No discussion of limitations. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Blanchard, O., Glorennec, P., Mercier, F., Bonvallot, N., Chevrier, C., Ramalho, O., Mandin, C., Le Bot, B. (2014). Semivolatile organic compounds in indoor air and settled dust in 30 French dwellings. Environmental Science & Technology 48(7):3959-3969. |
| **HERO ID:** | 2241683 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling is well described on page 3960 and includes dust and air sampling procedures. This is also presented in Table 2. |
| | Metric 2: | Analytical Methodology | High | The analytical procedures are presented sufficiently on page 3960. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers were not identified or relevant for this study. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study location is Brittany, Western France. |
| | Metric 5: | Currency | Medium | Sampling was done in 2011. |
| | Metric 6: | Spatial and Temporal Variability | High | Generally, there were at least 10 samples per scenario. |
| | Metric 7: | Exposure Scenario | High | The exposure scenario studied is relevant to TSCA-related exposure scenarios. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Results are well presented and discussed. |
| | Metric 9: | Quality Assurance | High | Replicates and recovery sampling were considered. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Relative standard deviations were considered in this study. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Zheng, X., Zhang, B. T., Teng, Y. (2014). Distribution of phthalate acid esters in lakes of Beijing and its relationship with anthropogenic activities. Science of the Total Environment 476-477:107-113. |
| **HERO ID:** | 2241688 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Well described and scientifically sound methodology |
| | Metric 2: | Analytical Methodology | High | Well described, includes LODs and recoveries |
| | Metric 3: | Biomarker Selection | N/A | Water sampling |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | Samples collected in 2012 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 4-10 samples per site |
| | Metric 7: | Exposure Scenario | Medium | Data are likely to represent a relevant exposure scenario, but the manuscript has limited description of the population of interest and microenvironment |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data points are not provided, only summary statistics |
| | Metric 9: | Quality Assurance | Medium | Limited details on field control samples |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Key uncertainties, limitations and data gaps are not discussed |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Das, M. T., Ghosh, P., Thakur, I. S. (2014). Intake estimates of phthalate esters for South Delhi population based on exposure media assessment. Environmental Pollution 189:118-125. |
| **HERO ID:** | 2298077 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology is thoroughly described and scientifically sound. No key details are omitted. |
| | Metric 2: | Analytical Methodology | High | Analytical method is thoroughly described and sound. MDL is provided in supplemental material. |
| | Metric 3: | Biomarker Selection | N/A | Study is testing for parent chemical in dust. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected in China. |
| | Metric 5: | Currency | Medium | Samples collected in 2011. |
| | Metric 6: | Spatial and Temporal Variability | Low | No replicates provided and fewer than 10 samples were collected per scenario. |
| | Metric 7: | Exposure Scenario | Medium | The source of exposure was not well characterized, but this is an exposure scenario of interest. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Raw data is provided. |
| | Metric 9: | Quality Assurance | High | QA/QC methods are provided and no issues were identified. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Robust discussion of limitations and uncertainty is provided. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Mercier, F., Gilles, E., Saramito, G., Glorennec, P., Le Bot, B. (2014). A multi-residue method for the simultaneous analysis in indoor dust of several classes of semi-volatile organic compounds by pressurized liquid extraction and gas chromatography/tandem mass spectrometry. Journal of Chromatography A 1336:101-111. |
| **HERO ID:** | 2298081 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Dust collected from household vacuum bags, sieved before sealed/frozen storage. |
| | Metric 2: | Analytical Methodology | High | Analysis via PLE-GC/MS/MS explained in detail with LOQ, matrix interference, etc. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | France, Brittany. |
| | Metric 5: | Currency | Medium | September 2009 through October 2012. |
| | Metric 6: | Spatial and Temporal Variability | Medium | N = 7 vacuum bags, 1 per dwelling. |
| | Metric 7: | Exposure Scenario | High | Indoor dust from family dwellings. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Raw data reported (n = 7). |
| | Metric 9: | Quality Assurance | High | Extensive QA to evaluate analytic methods; used SRM from US NIST; 3-level quantitative calibration. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Indoor dust, 1 analytic measure/dwelling, n = 7 dwellings; focus on performance of GC/MS/MS methods. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Christensen, K., Sobus, J., Phillips, M., Blessinger, T., Lorber, M., Tan, Y. M. (2014). Changes in epidemiologic associations with different exposure metrics: A case study of phthalate exposure associations with body mass index and waist circumference. Environment International 73:66-76. |
| **HERO ID:** | 2345925 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling procedure was reported throughout the first half of the paper; Simulation section has the most details. |
| | Metric 2: | Analytical Methodology | Low | Analytical method was not reported. However, data came from NHANES dataset which uses scientifically sound and robust methods. |
| | Metric 3: | Biomarker Selection | High | Biomarker is specific to parent chemical. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Data were collected from the US population. |
| | Metric 5: | Currency | Medium | Data were collected from 2009-2010. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Sample data include 10537 individuals. To be consistent with the guidance, metric is not scored as high because of missing replicates. |
| | Metric 7: | Exposure Scenario | Medium | The data represent relevant exposure scenario, but did not have much information on exposure pathway/product use. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Average data were reported. While sample size exceeded 10,000 so presenting raw data is less feasible, to be consistent with the guidance, the metric is not scored high. |
| | Metric 9: | Quality Assurance | Low | QA/QC techniques were not discussed, but can be inferred from use of NHANES data. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study had some characterization of variance and discussion on its strength and limitation regarding the simulation. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Arbuckle, T. E., Davis, K., Marro, L., Fisher, M., Legrand, M., Leblanc, A., Gaudreau, E., Foster, W. G., Choeurng, V., Fraser, W. D. (2014). Phthalate and bisphenol A exposure among pregnant women in Canada–results from the MIREC study. Environment International 68:55-65. |
| **HERO ID:** | 2345941 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Scientifically sound sampling methodology. |
| | Metric 2: | Analytical Methodology | High | Detailed analytical methodology, reported LOD. |
| | Metric 3: | Biomarker Selection | High | Metabolite is known to be related with external exposure. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Canada |
| | Metric 5: | Currency | Medium | Sampling began in 2008 and ended in 2011. |
| | Metric 6: | Spatial and Temporal Variability | Low | n = 1788, no replicates, single spot urine samples. |
| | Metric 7: | Exposure Scenario | High | Data closely represent relevant exposure scenarios. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data is not reported. |
| | Metric 9: | Quality Assurance | Low | Limited description of QA/QC techniques and recoveries not reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Characterized variability, discussed uncertainties and limitations. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Ait Bamai, Y., Shibata, E., Saito, I., Araki, A., Kanazawa, A., Morimoto, K., Nakayama, K., Tanaka, M., Takigawa, T., Yoshimura, T., Chikara, H., Saijo, Y., Kishi, R. (2014). Exposure to house dust phthalates in relation to asthma and allergies in both children and adults. Science of the Total Environment 485-486(Elsevier):153-163. |
| **HERO ID:** | 2345943 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Methods, equipment, storage described. Additional methods were published in previous manuscripts (Araki et al., 2014; Kanazawa et al., 2010; Saito et al., 2007) |
| | Metric 2: | Analytical Methodology | High | Extraction methods, analytical instrument (GC/MS), MDL, and recoveries reported. A calibration curve was constructed for GC/MS analysis. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Japan |
| | Metric 5: | Currency | Medium | sampling in 2006 |
| | Metric 6: | Spatial and Temporal Variability | High | More than 100 samples per matrix with replicates. |
| | Metric 7: | Exposure Scenario | High | Exposure to children and adults. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics. No individual data. |
| | Metric 9: | Quality Assurance | High | Control samples were analyzed, QA/QC method was described. High recoveries (over 70%). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability measured in the characteristics of subjects. Uncertainties and limitations were discussed. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Ferguson, K. K., Mcelrath, T. F., Ko, Y. A., Mukherjee, B., Meeker, J. D. (2014). Variability in urinary phthalate metabolite levels across pregnancy and sensitive windows of exposure for the risk of preterm birth. Environment International 70(Elsevier):118-124. |
| **HERO ID:** | 2345949 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling methods were reported as CDC guidelines, detailed elsewhere. |
| | Metric 2: | Analytical Methodology | Low | Analytical methods were assumed to be appropriate (following CDC guidelines) but not detailed |
| | Metric 3: | Biomarker Selection | High | Biomarker (parent chemical or metabolite) is derived from exposure to the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Boston |
| | Metric 5: | Currency | Medium | 2006 to 2008 |
| | Metric 6: | Spatial and Temporal Variability | Medium | The study included 130 mothers who delivered preterm, aswell as 352 controls selected randomly from subjects who had a urine sample from Visit 1 and from at least one additional visit. No indication of replicates |
| | Metric 7: | Exposure Scenario | Medium | The data likely represent the relevant exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data points were not reported, but supplementary tables provided information with detailed summary statistics. |
| | Metric 9: | Quality Assurance | Low | Quality assurance/quality control techniques and results were not directly discussed, but can be implied through the study's use of standard field and laboratory protocols. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study has limited discussion of key uncertainties, limitations, and data gaps, though the study mainly provided its strengths. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Serrano, S. E., Karr, C. J., Seixas, N. S., Nguyen, R. H., Barrett, E. S., Janssen, S., Redmon, B., Swan, S. H., Sathyanarayana, S. (2014). Dietary phthalate exposure in pregnant women and the impact of consumer practices. International Journal of Environmental Research and Public Health 11(6):6193-6215. |
| **HERO ID:** | 2345950 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling procedure was provided and included details on equipment, storage, and calibration. A copy of the survey questions is in the supplemental information. |
| | Metric 2: | Analytical Methodology | High | Analytical procedure was reported (HPLC-ESI-MS/MS). LOD was reported (0.2 and 2.0 ng/mL for the UW samplesand 0.2 and 0.6 ng/mL for the CDC samples). Data below LOD was properly addressed. |
| | Metric 3: | Biomarker Selection | High | Biomarker (parent chemical or metabolite) is derived from exposure to the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Participants are from hospitals in several states in the US |
| | Metric 5: | Currency | Medium | 2010-2012 |
| | Metric 6: | Spatial and Temporal Variability | High | 656 final samples were included |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant exposure scenario - concentrations in serum and dietary exposure/consumer practices was explored in details. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Average concentrations of metabolites were reported, no raw data were reported. Demographics, education, food consumption, personal care products and other consumer related practices summaries available in Table 2, 3, and 4. |
| | Metric 9: | Quality Assurance | High | QC was performed, no major concerns were seen. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | The study had a robust discussion of limitations and variability. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Mervish, N., Mcgovern, K. J., Teitelbaum, S. L., Pinney, S. M., Windham, G. C., Biro, F. M., Kushi, L. H., Silva, M. J., Ye, X., Calafat, A. M., Wolff, M. S., BCERP (2014). Dietary predictors of urinary environmental biomarkers in young girls, BCERP, 2004-7. Environmental Research 133C:19-Dec. |
| **HERO ID:** | 2345954 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Assumed samples were collected according to publicly available SOPs that are scientifically sound and widely accepted. The study is part of the Breast Cancer and Environment Research Program (BCERP). Urinary sample collection is not reported. However, the methodology has been described in other publication mentioned in the study and the samples were analyzed at the National Center for Environmental Health at the CDC. Also the study mention that all "specimen collection and storage materials were supplied by the CDC". |
| | Metric 2: | Analytical Methodology | High | Samples were analyzed according to publicly available analytical methods that are scientifically sound and widely accepted. LOD reported. Quantitation achieved by isotope dilution tandem mass spectrometry. QC samples used. |
| | Metric 3: | Biomarker Selection | High | Urinary metabolites used. Metabolites have precise quantitative relationship with external exposure and are derived from exposure to the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Geographic locations are reported: New York City, Cincinnati, and San Francisco Bay Area. |
| | Metric 5: | Currency | Medium | Sample collected 2004-2007. |
| | Metric 6: | Spatial and Temporal Variability | High | The study used a large sample size over a sufficient period of time to characterize trends (2004-2007). Used replicates. |
| | Metric 7: | Exposure Scenario | High | The study uses urinary phthalate biomarker as a dietary predictor. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Data reported by dietary intake. Also, supplementary or raw data (i.e., individual data points) are not reported , and therefore summary statistics cannot be reproduced. |
| | Metric 9: | Quality Assurance | High | Quality assurance reported in analytical methods. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability per serving and dietary. Limitations reported. |
| **Overall Quality Determination** | | | **High** | |

| | |
|---|---|
| **Study Citation:** | Gaspar, F. W., Castorina, R., Maddalena, R. L., Nishioka, M. G., Mckone, T. E., Bradman, A. (2014). Phthalate exposure and risk assessment in California child care facilities. Environmental Science & Technology 48(13):7593-7601. |
| **HERO ID:** | 2345959 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology was thoroughly described including the study population, visits, dust and indoor air sample collection procedures and sample storage. |
| | Metric 2: | Analytical Methodology | High | Analytical methodologies for dust and indoor air samples were described in detail including extraction method, analytical instrumentation, reproducible samples. The method detection limit (MDL) for dust and instrument limit of detection (IDL) for indoor air were reported in text on page 7594. Recovery percentages are reported in the SI table S1. |
| | Metric 3: | Biomarker Selection | N/A | This study measured the parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was completed at the Alameda and Monterey Counties, California. |
| | Metric 5: | Currency | Medium | Samples were collected from May 2010 to May 2011. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 40 early childhood education facilities were enrolled in the study. Indoor air samples were collected from all 40 locations and dust samples were collected from 39 locations. Replicate samples were not reported. |
| | Metric 7: | Exposure Scenario | High | This data in this study suggests chemical exposure to children through dust and indoor air in early childhood education facilities. There were no exposure control samples. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics of dust and indoor air concentrations were detailed including mean, standard deviation, range, detection frequency, and percentiles. Raw data were not reported. |
| | Metric 9: | Quality Assurance | High | QA/QC procedures were reporting including relative percent difference, field duplicates, field blanks, field spikes, and laboratory spikes are presented in SI Table S1. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability of dust and indoor air were well characterized. The study reported the standard deviation, range, 5th, 25th, 50th, 75th, and 95th percentiles of concentrations. Limitations were reported in the discussion section. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Meng, X. Z., Wang, Y., Xiang, N., Chen, L., Liu, Z., Wu, B., Dai, X., Zhang, Y. H., Xie, Z., Ebinghaus, R. (2014). Flow of sewage sludge-borne phthalate esters (PAEs) from human release to human intake: implication for risk assessment of sludge applied to soil. Science of the Total Environment 476-477(Elsevier):242-249. |
| **HERO ID:** | 2345986 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | WWTP details included, map in SI, and storage conditions reported. Sampling methods reported previously (Yang, et al., 2011). |
| | Metric 2: | Analytical Methodology | High | Instrument DL and method DL in Table S2. Extraction and instruments also described in detail. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | 2010 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 25 WWTP samples, no replicates |
| | Metric 7: | Exposure Scenario | High | Measuring sewage sludge from WWTP. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Mean, median, min, max reported in Table 1. Raw data not reported. |
| | Metric 9: | Quality Assurance | High | Recoveries, DLs, blanks discussed. Recoveries above 70%. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability, limitations, and uncertainty not discussed, but there are no obvious concerns. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Wang, W., Li, M.,ei, Cui, Y., Gao, X., Chen, K.,un, Qian, X.,in (2014). Potential health impact and genotoxicity analysis of drinking source water from Liuxihe Reservoir (PR China). Ecotoxicology 23(4):647-656. |
| **HERO ID:** | 2346041 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Methodology is well described. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods, such as sample extraction and analytical instrument, LODs/LOQs, and recoveries were described. |
| | Metric 3: | Biomarker Selection | N/A | The study tested for parent chemicals in a drinking water reservoir. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study collected samples from a reservoir in Guangzhou, China. |
| | Metric 5: | Currency | Medium | Samples were collected in 2010. |
| | Metric 6: | Spatial and Temporal Variability | Low | Four samples and no replicates were collected from the drinking water reservoir. |
| | Metric 7: | Exposure Scenario | High | Exposure to contaminants to drinking water is a relevant exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data are presented, but summary statistics are missing parameters (e.g. SD, detection frequency). |
| | Metric 9: | Quality Assurance | Low | There is some discussion on the potential genotoxicity experiment, but not on the monitoring/sampling data of the drinking water source, which is the primary piece of interest. For recoveries, authors reported that they were all above 66.4% and provided no further details. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | There is no characterization of variance or discussion of uncertainties and study limitations related to the sampling data. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Watkins, D. J., Eliot, M., Sathyanarayana, S., Calafat, A. M., Yolton, K., Lanphear, B. P., Braun, J. M. (2014). Variability and Predictors of Urinary Concentrations of Phthalate Metabolites during Early Childhood. Environmental Science & Technology 48(15):8881-8890. |
| **HERO ID:** | 2347098 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Spot urine samples collected either at home or in clinic (some in both); diaper inserts used for ages 1 to 3 years. |
| | Metric 2: | Analytical Methodology | Low | Described in SI. SPE-HPLC-MS/MS. Analyses performed by CDC laboratory following strict CLIA QC guidelines. Followed 2011-2012 NHANES protocols for phthalate metabolites. LOD reported only as range (0.1 to 1 ng/mL), however. |
| | Metric 3: | Biomarker Selection | High | Concentration of BBzP in urine. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Ohio, Cincinnati |
| | Metric 5: | Currency | Medium | 2004 through 2011 |
| | Metric 6: | Spatial and Temporal Variability | Low | Spot urine samples: compared at home versus clinic collection; compared samples taken 2 weeks apart to those taken 1 year apart for same individual. Total 296 children ages 1 through 5 years. |
| | Metric 7: | Exposure Scenario | Medium | Questionnaires covered diet, food packaging, consumption of fast food, and personal product use. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Reported in Supplemental Information. Concentrations (ug/L) reported: median, 25th, and 75th percentiles (Table S3); box-and-whisker plots also show arithmetic mean, min, and max (Figure S1). |
| | Metric 9: | Quality Assurance | High | CDC followed quality control as per the Clinical Laboratory Improvement Act QC guidelines and German External Quality Assessment Scheme. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Evaluated metabolite concentrations relative to demographic characteristics, food packaging and personal care products, age, and other factors. |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | Frederiksen, H., Kuiri-Hänninen, T., Main, K. M., Dunkel, L., Sankilampi, U. (2014). A longitudinal study of urinary phthalate excretion in 58 full-term and 67 preterm infants from birth through 14 months. Environmental Health Perspectives 122(9):998-1005. |
| **HERO ID:** | 2347101 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most key criteria met - including equipment and storage. Duration of sample storage prior to analysis lacking. |
| | Metric 2: | Analytical Methodology | Medium | Most key criteria met - instrument described, recoveries, analytic methods referenced (Frederiksen et al. 2010) with more information, LOD's reported, creatine adjusted concentrations. |
| | Metric 3: | Biomarker Selection | High | Sampling for metabolites specific for parent chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected from participants in Kuopio, Finland. |
| | Metric 5: | Currency | Medium | Sampling conducted 2006-2008. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Spot urine sampling conducted with repeated samples provided by n=125 children at days 1-3, day 7, monthly at months 1-6 and month 14, with a total of 894 urine specimens provided, non-statistical sampling approach. |
| | Metric 7: | Exposure Scenario | Medium | Participant characteristics described, occupational status of mother not reported, lack of exposure controls however repeated sampling provided over 14 months. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Most key criteria met. Lack of raw data. Summary statistics and mean reported. |
| | Metric 9: | Quality Assurance | High | Key criteria met, lack of baseline pre-exposure data however repeated sampling over 14 months. Recoveries reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability characterized within summary statistics and different variables, potential limitations discussed, including the potential for reverse causality within premature infants. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Bergé, A., Gasperi, J., Rocher, V., Gras, L., Coursimault, A., Moilleron, R. (2014). Phthalates and alkylphenols in industrial and domestic effluents: case of Paris conurbation (France). Science of the Total Environment 488-489(1):26-35. |
| **HERO ID:** | 2347158 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | effluent sources described, sampling described. Limited information on sampling equipment and storage conditions/duration |
| | Metric 2: | Analytical Methodology | Low | accredited labs; equipment and extraction described; quantification limit was 0.2ug/l for all congeners in liquid phase and 0.05 mg/kg in dry weight |
| | Metric 3: | Biomarker Selection | N/A | parent compounds measured in industrial and domestic discharges |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | France |
| | Metric 5: | Currency | Low | published 2014. no sampling date provided |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 2 to 45 depending on sector, no replicates |
| | Metric 7: | Exposure Scenario | High | Study measured chemical concentrations in different types of industrial and domestic waste discharges. Data can be used to predict how this might affect receiving waters. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | min, median, max provided. No raw data |
| | Metric 9: | Quality Assurance | Low | QA/QC were not directly discussed, but can be implied through use of French accreditation procedures (NF—T 90-210 and NF—T90-220standards). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Some discussion of variance and uncertainty |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Xu, Y., Liang, Y., Urquidi, J. R., Siegel, J. A. (2015). Semi-volatile organic compounds in heating, ventilation, and air-conditioning filter dust in retail stores. Indoor Air 25(1):79-92. |
| **HERO ID:** | 2347161 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sample procedures and storage conditions reported |
| | Metric 2: | Analytical Methodology | High | Instrumental detection limit and method detection limits reported in table 2. |
| | Metric 3: | Biomarker Selection | High | BBP concentrations in HVAC filter dust |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Texas and Pennsylvania |
| | Metric 5: | Currency | Medium | Timing of sample collection is not reported, siegel 2013 has sample dates in table 3.1. |
| | Metric 6: | Spatial and Temporal Variability | High | Triplicate samples, filters were placed for 30 days. |
| | Metric 7: | Exposure Scenario | High | Occurrence of phthalates in dust samples of U.S. retail stores. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual samples not reported. Table 2 Distribution of phthalate and PBDE concentrations in HVAC filter dust (mean, SD, percentiles and max). |
| | Metric 9: | Quality Assurance | High | Analytical recovery efficiencies between 77% and 92% |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Standard deviation, and reports key limitations |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Valton, A. S., Serre-Dargnat, C., Blanchard, M., Alliot, F., Chevreuil, M., Teil, M. J. (2014). Determination of phthalates and their by-products in tissues of roach (Rutilus rutilus) from the Orge river (France). Environmental Science and Pollution Research 21(22):12723-12730. |
| **HERO ID:** | 2347469 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sample collection described for fish (roach) upstream and downstream. Location and map provided plus site description and some history. River surface water collected via grab sample method. Fish livers and muscles were collected after dissection in the lab. Missing approaches to avoid phthalate contamination, missing surface grab water description such as approximate thickness of surface layer sampled. |
| | Metric 2: | Analytical Methodology | High | Sample processing, methods, and equipment provided. Phthalates diesters were analyzed by high resolution gas chromatography/mass spectrometry. Phthalate monoesters were quantified as triplicates, by high performance liquid chromatography (1200 series; Agilent Technologies, Massy, France)–tandem mass spectrometry, (HPLC-MS/MS). Limits of quantification (LOQs) for roach tissues are indicated in Appendix 2 and 4. |
| | Metric 3: | Biomarker Selection | High | Biomarkers selected are appropriate for parent phthalates, see table 3 for DEHP metabolites. Table 2 has metabolites for other phthalates. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | France |
| | Metric 5: | Currency | Low | publication date 2014, sampling date not provided |
| | Metric 6: | Spatial and Temporal Variability | Low | n = 4 for liver and muscle, unclear about surface water |
| | Metric 7: | Exposure Scenario | Medium | fish from the Orge River and surface water |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | mean and SD reported in Table 1 |
| | Metric 9: | Quality Assurance | High | Analytical QA/QC described and reported in appendices. Blanks, internal standards, recoveries, LOQs and triplicate analysis of each sample. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Sources of uncertainty and variability discussed in Roach contamination Section of the paper starting page 8. |
| **Overall Quality Determination** | | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | Liu, H., Cui, K., Zeng, F., Chen, L., Cheng, Y., Li, H., Li, S., Zhou, X., Zhu, F., Ouyang, G., Luan, T., Zeng, Z. (2014). Occurrence and distribution of phthalate esters in riverine sediments from the Pearl River Delta region, South China. Marine Pollution Bulletin 83(1):358-365. |
| **HERO ID:** | 2349860 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported |
| | Metric 2: | Analytical Methodology | Medium | Key analytical methods reported. Only provided a range of MDLs for all phthalates analyzed |
| | Metric 3: | Biomarker Selection | N/A | Measured parent chemical in riverine sediments |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Pearl River Delta region, South China |
| | Metric 5: | Currency | Low | Paper published in 2014. No sample collection date reported |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples, no replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | raw data not reported |
| | Metric 9: | Quality Assurance | Medium | Some QA/QC reported, such as blanks and recoveries. However, the lower bound of recoveries were <70% for some compounds albeit not significantly. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Van Holderbeke, M., Geerts, L., Vanermen, G., Servaes, K., Sioen, I., De Henauw, S., Fierens, T. (2014). Determination of contamination pathways of phthalates in food products sold on the Belgian market. Environmental Research 134:345-352. |
| **HERO ID:** | 2501473 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some sampling methods not reported such as sample storage conditions |
| | Metric 2: | Analytical Methodology | High | analytical methods described |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Belgium |
| | Metric 5: | Currency | Medium | Samples collected in 2010 and 2011 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | High | Exposure source characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported |
| | Metric 9: | Quality Assurance | Medium | Limited QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Sakhi, A. K., Lillegaard, I. T., Voorspoels, S., Carlsen, M. H., Løken, E. B., Brantsæter, A. L., Haugen, M., Meltzer, H. M., Thomsen, C. (2014). Concentrations of phthalates and bisphenol A in Norwegian foods and beverages and estimated dietary exposure in adults. Environment International 73:259-269. |
| **HERO ID:** | 2501495 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Food selection criteria and pertinent sampling methods were described. Note that some of the sampling parameters (e.g., equipment) do not apply to this study because food were purchased as sold from grocery stores. |
| | Metric 2: | Analytical Methodology | High | LOQs were provided in Table S1. Extraction, preparation, and instrumentation were described, including reference to previously published protocol. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemicals were measured in food. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Food samples were collected in Norway. |
| | Metric 5: | Currency | Medium | Samples were collected in 2012. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 37 different food items and beverages were selected, and the top 1-3 brands for each item were pooled into one sample. No replicates were reported. |
| | Metric 7: | Exposure Scenario | High | Exposure to typical Norwegian food purchases from local grocery store is relevant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics, such as median, min, and max were reported. No raw data were provided. |
| | Metric 9: | Quality Assurance | High | Method performance described blanks, reference samples, LOQ, recovery, and intralaboratory reproducibility in both main text and SI. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variance characterized with ranges and some limitations were discussed. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Domínguez-Morueco, N., González-Alonso, S., Valcárcel, Y. (2014). Phthalate occurrence in rivers and tap water from central Spain. Science of the Total Environment 500-501:139-146. |
| **HERO ID:** | 2510737 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | single sampling collected 100m from discharge points of 7 WWTPs that discharge into the Jarama and Manzanares rivers (Fig 1; Table S1); drinking water from 7 taps (Fig 2; Table S2); time of day collected provided; collected in opaque bottles and stored frozen |
| | Metric 2: | Analytical Methodology | High | SPE; GC-MS; recoveries; LOD and LOQ provided in Table 1 |
| | Metric 3: | Biomarker Selection | N/A | Tested parent chemicals in river near WWTP discharge and tap water |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Madrid, Central Spain |
| | Metric 5: | Currency | Medium | 2012 |
| | Metric 6: | Spatial and Temporal Variability | Low | Single sampling event in February that collected from 4 sites along the Manzanares and 3 sites along the Jarama. Drinking water collected from 7 private taps in December. No replicates |
| | Metric 7: | Exposure Scenario | High | concentration in rivers from region in Spain that is most densely populated and large number of industries; also concentration in drinking water |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Table 2 provides raw data per site as well as mean, std, and DF in river water. Table 3 provides the same information for drinking water. |
| | Metric 9: | Quality Assurance | High | Recoveries reported in Table 1 and all were acceptable. Blank analysis was performed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Compared values to previous studies within Spain and other countries, between the sampling sites and the two rivers, and between the rivers and drinking water. Variance characterized with SD when applicable. Limited discussion of uncertainties and gaps. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Larsson, K., Ljung Björklund, K., Palm, B., Wennberg, M., Kaj, L., Lindh, C. H., Jönsson, B. A., Berglund, M. (2014). Exposure determinants of phthalates, parabens, bisphenol A and triclosan in Swedish mothers and their children. Environment International 73:323-333. |
| **HERO ID:** | 2510755 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The sampling methodology is based on the European consensus protocol of COPHES/DEMOCOPHES |
| | Metric 2: | Analytical Methodology | High | Samples were analyzed following an interlaboratory SOP. LOD is reported |
| | Metric 3: | Biomarker Selection | High | Monobenzyl phthalate (MBzP) as a metabolite for BBP |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Sweden in urban and rural areas following a protocol. |
| | Metric 5: | Currency | Low | QCer cannot verify that samples were collected between 2010-2012, as initial reviewer noted. Paper was published in 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 95 mothers and 97 children. No replicate samples |
| | Metric 7: | Exposure Scenario | High | Mother and children living in urban and rural areas |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No individual sample concentrations. Table 1 presents the levels of phthalate metabolites in GM (95% CI) and percentiles |
| | Metric 9: | Quality Assurance | High | The study had two interlaboratory comparison investigations and two external quality assessment schemes (ICI/EQUAS). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | The study characterizes variability in the results with 95% CI and percentiles, but does not report limitations |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Whyatt, R. M., Perzanowski, M. S., Just, A. C., Rundle, A. G., Donohue, K. M., Calafat, A. M., Hoepner, L. A., Perera, F. P., Miller, R. L. (2014). Asthma in inner-city children at 5-11 years of age and prenatal exposure to phthalates: the Columbia Center for Children's Environmental Health Cohort. Environmental Health Perspectives 122(10):1141-1146. |
| **HERO ID:** | 2510815 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Low. Most key criteria not described. Sampling equipment, sample storage conditions, duration of sample storage, lacking. |
| | Metric 2: | Analytical Methodology | Low | Low. Some key criteria briefly described, samples analyzed by CDC with methodology referenced, lack of LOD data. |
| | Metric 3: | Biomarker Selection | Low | Low. Sampling for metabolites not specific for parent chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Samples provided by participants in Harlem and New York, New York hospitals. |
| | Metric 5: | Currency | Medium | Medium. Prenatal spot urine samples collected 1998-2006. Only prenatal concentrations reported. |
| | Metric 6: | Spatial and Temporal Variability | Low | Low. Single prenatal 3rd trimester spot urine specimens obtained from n=300 participants |
| | Metric 7: | Exposure Scenario | Medium | Medium. Participant characteristics summarized, lack of information on pre-exposure or control samples. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Most key criteria met; lack of raw data. |
| | Metric 9: | Quality Assurance | Medium | Medium. Quality assurance procedures not described however analytic methods referenced and samples noted as analyzed at CDC labs. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | High. Variability characterized within summary statistics in Table 2. Study limitations discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Wang, J., Bo, L., Li, L., Wang, D., Chen, G., Christie, P., Teng, Y. (2014). Occurrence of phthalate esters in river sediments in areas with different land use patterns. Science of the Total Environment 500:113-119. |
| **HERO ID:** | 2510816 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | All key sampling methods reported, including reference to another study for treatment and analysis. |
| | Metric 2: | Analytical Methodology | Medium | Most key analytical methods described except MDLs, which were reported as a range for all phthalates combined. |
| | Metric 3: | Biomarker Selection | N/A | Tested for parent chemical in river sediment |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Changshu, China |
| | Metric 5: | Currency | Medium | Samples collected in 2012 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | High | Exposure scenario characterized and is relevant |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | raw data not reported |
| | Metric 9: | Quality Assurance | High | QA reported with blank procedures and acceptable recoveries |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No gaps and limitations reported |

## Overall Quality Determination Medium

**Study Citation:** Frederiksen, H., Kranich, S. K., Jørgensen, N., Taboureau, O., Petersen, J. H., Andersson, A. M. (2013). Temporal variability in urinary phthalate metabolite excretion based on spot, morning, and 24-h urine samples: considerations for epidemiological studies. Environmental Science & Technology 47(2):958-967.

**HERO ID:** 2516456

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Detailed sampling methods, including timing of collection, storage, and equipment used. |
| | Metric 2: | Analytical Methodology | High | Well described analytical methods, including instrument, calibration curve, LOD, blank urine pool provided. |
| | Metric 3: | Biomarker Selection | High | Metabolites known to be derived from parent chemical (MBzP, MnBP). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Denmark |
| | Metric 5: | Currency | Medium | Samples taken in 2008 |
| | Metric 6: | Spatial and Temporal Variability | High | n=33, with triplicates over a three month period. 24 hr, morning void, and spot samples all collected. |
| | Metric 7: | Exposure Scenario | Medium | Men sampled but there is little information given about them and source of exposure. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics (min, max, percentiles). No individual points. |
| | Metric 9: | Quality Assurance | High | Described QA/QC techniques described in another study, analyzed control samples. High recoveries (over 70%). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Characterized variability, discussed uncertainties and limitations, and compared the different modes of urine collection. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Kong, S., Ji, Y., Liu, L., Chen, L., Zhao, X., Wang, J., Bai, Z., Sun, Z. (2012). Diversities of phthalate esters in suburban agricultural soils and wasteland soil appeared with urbanization in China. Environmental Pollution 170(Elsevier):161-168. |
| **HERO ID:** | 2518980 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported |
| | Metric 3: | Biomarker Selection | N/A | Tested parent chemicals in soil |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Tianjin, China |
| | Metric 5: | Currency | Medium | Samples collected in 2009 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | High | Exposure source characterized. Exposure scenario is relevant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported |
| | Metric 9: | Quality Assurance | High | QA reported. Recoveries acceptable |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Gaps and limitations not well characterized |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Takeuchi, S., Kojima, H., Saito, I., Jin, K., Kobayashi, S., Tanaka-Kagawa, T., Jinno, H. (2014). Detection of 34 plasticizers and 25 flame retardants in indoor air from houses in Sapporo, Japan. Science of the Total Environment 491-492:28-33. |
| **HERO ID:** | 2519043 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology is mostly adequately described, but some details are missing (e.g., sample storage conditions/duration). The study does cite some other published works for more complete details. |
| | Metric 2: | Analytical Methodology | Medium | The analytical methods were described, including LOD but not recoveries. |
| | Metric 3: | Biomarker Selection | N/A | Concentrations were measured in indoor air. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Sapporo, Japan. |
| | Metric 5: | Currency | Medium | Samples were collected in 2012. |
| | Metric 6: | Spatial and Temporal Variability | Low | It appears that only one sample per home was collected. Six homes were sampled. |
| | Metric 7: | Exposure Scenario | Medium | The data may represent relevant exposure scenarios related to indoor air in Sapporo Japan but only 6 homes were sampled. One home was sampled during a different season from the other homes. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual sample concentrations were reported, without summary statistics. |
| | Metric 9: | Quality Assurance | Medium | QA/QC techniques were briefly discussed, including the use of field blanks. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability was not characterized. Very limited discussion of limitations, uncertainties, and data gaps. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Tran, B. C., Teil, M. J., Blanchard, M., Alliot, F., Chevreuil, M. (2014). BPA and phthalate fate in a sewage network and an elementary river of France. Influence of hydroclimatic conditions. Chemosphere 119C:43-51. |
| **HERO ID:** | 2519056 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Well described sampling methodology. |
| | Metric 2: | Analytical Methodology | Low | Limited data on recovery samples and detection limits not reported by chemical. |
| | Metric 3: | Biomarker Selection | N/A | Tested for parent chemical in wastewater and river water. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | France. |
| | Metric 5: | Currency | Medium | Sampling in 2010-2011. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 4 sites sampled 12 times. no replicates. |
| | Metric 7: | Exposure Scenario | Medium | Limited data on population of interest and microenvironment. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics, raw data not provided. |
| | Metric 9: | Quality Assurance | Medium | Laboratory control samples were analyzed, limited information on field controls and recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited discussion of limitations, data gaps and uncertainties. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Selvaraj, K. K., Sundaramoorthy, G., Ravichandran, P. K., Girijan, G. K., Sampath, S., Ramaswamy, B. R. (2015). Phthalate esters in water and sediments of the Kaveri River, India: environmental levels and ecotoxicological evaluations. Environmental Geochemistry and Health 37(1):83-96. |
| **HERO ID:** | 2519070 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Surface water and sediment were collected from 16 locations (Fig 1) during dry season of 2012. Water was collected using glass bottles and stored at 4C until extraction within a week. Grab samples of sediments were collected in bags and stored at -20C until extraction. |
| | Metric 2: | Analytical Methodology | High | Authors cited a peer reviewed paper for their solid-phase extraction procedure for water samples. Ultrasonic methods used for extraction from sediment. Chemicals were analyzed using GC-MS. Table 1 provides recoveries, LOD, and LOQ per chemical. |
| | Metric 3: | Biomarker Selection | N/A | The study tested the parent chemicals in riverine water and sediment. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in the Kaveri River, India. |
| | Metric 5: | Currency | Medium | Samples were collected between 2010 and 2012 (2010-2011 for sediment samples and 2012 for water samples). |
| | Metric 6: | Spatial and Temporal Variability | Medium | Samples were collected from 16 locations along the river during dry season and sediment samples were archived from 2010-2011. SI provides more details on sampling sites. Replicate samples were not collected. |
| | Metric 7: | Exposure Scenario | High | Authors measured chemical concentrations in water and sediment of one of the largest rivers in southern India, where water is abstracted for irrigation, drinking, and industrial processes. Sampling was conducted in rural and urban environments in proximity to agricultural areas, cities, and industries |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Concentration data are provided in Figures 2 and 3 for riverine water and sediment, as well as in text starting on p.88. Summary statistics include detection frequencies, mean, and range. Raw data provided in SI. |
| | Metric 9: | Quality Assurance | Medium | QA/QC techniques included spiking, blanks, and recovery samples. However, Table 1 showed that the extraction method for water showed recovery of 33% for BBP; it is unclear if/how authors corrected for the low recovery. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | There is no discussion of limitations, uncertainties, or data gaps. Characterization of variance is minimal with just graphical representations of phthalate distribution in water and sediment along the river (Fig 3). |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Niu, L., Xu, Y., Xu, C., Yun, L., Liu, W. (2014). Status of phthalate esters contamination in agricultural soils across China and associated health risks. Environmental Pollution 195:16-23. |
| **HERO ID:** | 2519080 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methods, equipment, storage reported. |
| | Metric 2: | Analytical Methodology | Medium | Extraction methods, analytical methods, equipment, calibration, recovery samples reported. LOD reported as a range. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | Samples collected in 2013 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 123 samples. No replicates collected. |
| | Metric 7: | Exposure Scenario | High | Exposure sources characterized (application of agricultural plastic films and activities for soil fertility). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Mean, median, min, max provided. Raw data not reported. |
| | Metric 9: | Quality Assurance | High | Key QA reported. Recoveries over 70% and blank samples included. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | No gaps and limitations reported. Spatial variation analyzed and SD reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Watkins, D. J., Téllez-Rojo, M. M., Ferguson, K. K., Lee, J. M., Solano-Gonzalez, M., Blank-Goldenberg, C., Peterson, K. E., Meeker, J. D. (2014). In utero and peripubertal exposure to phthalates and BPA in relation to female sexual maturation. Environmental Research 134:233-241. |
| **HERO ID:** | 2519083 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The study population and sample collection methods were described. |
| | Metric 2: | Analytical Methodology | Medium | LOD provided in Table 1. Samples were analyzed at NSF International using ID-LC-MS/MS and specific gravity was accounted for. Other details were not reported. |
| | Metric 3: | Biomarker Selection | High | MBzP is specific to BBP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was performed in Mexico. |
| | Metric 5: | Currency | Medium | Study was performed in 2010. |
| | Metric 6: | Spatial and Temporal Variability | Low | Over 100 samples were collected from both mothers and children without replicates. Furthermore, only unpooled urine spot samples were collected. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study were exposure already occurred in utero for children. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Geometric means and percentiles were provided, but not raw data. |
| | Metric 9: | Quality Assurance | Low | QA/QC techniques were not discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variance was not characterized and uncertainties, limitations, and data gaps were not discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Cutanda, F., Koch, H. M., Esteban, M., Sánchez, J., Angerer, J., Castaño, A. (2015). Urinary levels of eight phthalate metabolites and bisphenol A in mother-child pairs from two Spanish locations. International Journal of Hygiene and Environmental Health 218(1):47-57. |
| **HERO ID:** | 2519084 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Standard Operation Procedures (SOPs) were followed in the collection of samples (Schindler et al., 2014). Missing approaches to avoid contamination, although it could be described in Schindler et al. |
| | Metric 2: | Analytical Methodology | Medium | Assessment done by Institute for Prevention and Occupational Medicine (IPA) laboratory (Koch et al., 2012, 2013; Kasper-Sonnenberg et al., 2012a,b). LOQ provided. Use on-line LC/LC–MS/MS with isotope dilution after enzymatic deconjugation. |
| | Metric 3: | Biomarker Selection | High | Metabolite in urine, see Table 1 |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Spain |
| | Metric 5: | Currency | Medium | 2011-2012 |
| | Metric 6: | Spatial and Temporal Variability | High | n = 118 mothers and 119 children, no replicates, urine morning void |
| | Metric 7: | Exposure Scenario | High | Biomonitoring, mother and child |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not provided, summary tables in supplemental: GM, P95, max. |
| | Metric 9: | Quality Assurance | Medium | external quality assurance by the Quality Assessment Unit of COPHES/DEMOCOPHES as described in detail by Schindler et al. (2014). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability between rural and urban locations was described as well as food consumption as a source of the variability among groups. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Geens, T., Bruckers, L., Covaci, A., Schoeters, G., Fierens, T., Sioen, I., Vanermen, G., Baeyens, W., Morrens, B., Loots, I., Nelen, V., de Bellevaux, B. N., Larebeke, N. V., Hond, E. D. (2014). Determinants of bisphenol A and phthalate metabolites in urine of Flemish adolescents. Environmental Research 134:110-117. |
| **HERO ID:** | 2519090 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Flemish Environment and Health Study (FLEHS) 2007–2012 enrollment described, morning urine samples |
| | Metric 2: | Analytical Methodology | Medium | LOQ in text; analysis - Koch et al.(2003). method performance (Servaes et al.,2013). Provided sufficient details describing metabolite detection, but not much about the creatinine |
| | Metric 3: | Biomarker Selection | High | metabolite in urine |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Belgium |
| | Metric 5: | Currency | Medium | 2008-2009 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 206, no replicates |
| | Metric 7: | Exposure Scenario | High | General population children 14-15 years of age, biomonitoring data (urine). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | GM, median, P25, P75, P90, P95, min, max |
| | Metric 9: | Quality Assurance | Medium | QA briefly described in analytical recoveries and duplicate sample analysis. Missing analytical blanks and field sample blanks mention. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | variability and uncertainty discussed according to the study goals |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Zhang, Y., Meng, X., Chen, L., Li, D., Zhao, L., Zhao, Y., Li, L., Shi, H. (2014). Age and Sex-Specific Relationships between Phthalate Exposures and Obesity in Chinese Children at Puberty. PLoS ONE 9(8):e104852. |
| **HERO ID:** | 2519091 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported |
| | Metric 2: | Analytical Methodology | Medium | Recovery samples not reported, missing analytical blanks |
| | Metric 3: | Biomarker Selection | Medium | acceptable biomarkers for DEHP. Authors did not link metabolites MBP, MMP, and MEP to other phthalates, but they were measured. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | Samples collected in 2011 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | Medium | General Population, children of various age groups and gender in China. Link to obesity and phthalates, may be useful for PESS analysis. Unclear of its applicability to US children |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported |
| | Metric 9: | Quality Assurance | Medium | QA/QC reported, missing analytical recoveries, analytical blanks, field blanks. However, described process to assess variability and uncertainty from various measurements. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Described sources of variability and uncertainty within the study goals. Although missing a few QA/QC parameters other descriptions provide confidence in the measurements. |

## Overall Quality Determination — Medium

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|---|---|
| **Study Citation:** | Fu, P., Kawamura, K., Barrie, L. A. (2009). Photochemical and other sources of organic compounds in the Canadian high Arctic aerosol pollution during winter-spring. Environmental Science & Technology 43(2):286-292. |
| **HERO ID:** | 2592659 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology reported. |
| | Metric 2: | Analytical Methodology | High | Analytical methodology well described. |
| | Metric 3: | Biomarker Selection | N/A | Chemical in environmental media (air). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Geographic location is reported; Canadian high Arctic. |
| | Metric 5: | Currency | Low | Data collected Feb to June 1991. Timing of sample collection for monitoring data is not consistent with when current exposures (>15 years old) may be expected and likely to have a substantial impact on results. |
| | Metric 6: | Spatial and Temporal Variability | Low | Sample size not reported but samples collected weakly from February to June. |
| | Metric 7: | Exposure Scenario | High | Chemicals in the Canadian high Arctic aerosol. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Supplementary or raw data (i.e., individual data points) are reported in the supplemental file, allowing summary statistics to be calculated or reproduced. |
| | Metric 9: | Quality Assurance | High | The study applied QA/QC measures such as field and lab control samples. Recoveries were high. No QA/QC issues identified. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No limitations and uncertainties discussed. However, no standard deviation or other measure of variance is provided. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Pollack, A. Z., Buck Louis, G. M., Chen, Z., Sun, L., Trabert, B., Guo, Y., Kannan, K. (2014). Bisphenol A, benzophenone-type ultraviolet filters, and phthalates in relation to uterine leiomyoma. Environmental Research 137C:101-107. |
| **HERO ID:** | 2718036 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most key criteria not reported. However, reference to another paper was cited for complete details on study methods. |
| | Metric 2: | Analytical Methodology | Medium | Most key criteria met. LODs were reported in Table 2. Recovery data were missing. |
| | Metric 3: | Biomarker Selection | Low | Sampling for metabolites not specific for parent chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Urine samples collected from participants in Salt Lake City, Utah and San Francisco, California. |
| | Metric 5: | Currency | Medium | Sampling conducted during 2007-2009. |
| | Metric 6: | Spatial and Temporal Variability | Low | Single spot urine samples collected from n=431 participants in Utah and n=63 participants in California (non-statistical sampling method). There was no report of replicate sampling. |
| | Metric 7: | Exposure Scenario | High | Participant characteristics were summarized. Potential sources were described as widespread exposure to personal care products. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were missing. |
| | Metric 9: | Quality Assurance | High | Quality assurance procedures reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability was characterized within statistical summary data. Potential study limitations were only briefly reported. |

## Overall Quality Determination Medium

**Study Citation:** Den Hond, E., Govarts, E., Willems, H., Smolders, R., Casteleyn, L., Kolossa-Gehring, M., Schwedler, G., Seiwert, M., Fiddicke, U., Castaño, A., Esteban, M., Angerer, J., Koch, H. M., Schindler, B. K., Sepai, O., Exley, K., Bloemen, L., Horvat, M., Knudsen, L. E., Joas, A., Joas, R., Biot, P., Aerts, D., Koppen, G., Katsonouri, A., Hadjipanayis, A., Krskova, A., Maly, M., Mørck, T. A., Rudnai, P., Kozepesy, S., Mulcahy, M., Mannion, R., Gutleb, A. C., Fischer, M. E., Ligocka, D., Jakubowski, M., Reis, M. F., Namorado, S., Gurzau, A. E., Lupsa, I. R., Halzlova, K., Jajcaj, M., Mazej, D., Snoj Tratnik, J., López, A., Lopez, E., Berglund, M., Larsson, K., Lehmann, A., Crettaz, P., Schoeters, G. (2014). First steps toward harmonized human biomonitoring in Europe: Demonstration project to perform human biomonitoring on a European scale. Environmental Health Perspectives 123(3):255-263.

**HERO ID:** 2718042

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The sampling methodology is based on the European consensus protocol of COPHES. |
| | Metric 2: | Analytical Methodology | High | Samples were analyzed following a interlaboratory SOP, more information found in (Becker et al. 2014, Schindler et al. 2014). LOQ are reported per country and metabolite. |
| | Metric 3: | Biomarker Selection | High | Metabolite known to be derived from parent chemical (MBzP, MnBP). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in 17 European countries in urban and rural areas following a protocol. |
| | Metric 5: | Currency | Medium | 2010-2012 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 1844 paired children and mother. No replicate samples. Morning urine samples. |
| | Metric 7: | Exposure Scenario | High | Mother and children living in 17 European countries in urban and rural areas |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No individual results reported, but GM and (95%CI) reported. |
| | Metric 9: | Quality Assurance | High | The study had two interlaboratory comparison investigations and two external quality assessment schemes (ICI/EQUAS). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study characterizes variability in the demographics and behaviors of the study population, but does not report limitations. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Kong, L., Kadokami, K., Wang, S., Duong, H. T., Chau, H. T. (2015). Monitoring of 1300 organic micro-pollutants in surface waters from Tianjin, North China. Chemosphere 122:125-130. |
| **HERO ID:** | 2718045 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The sampling method summary was brief but comprehensive. |
| | Metric 2: | Analytical Methodology | High | Extraction methods and use of various mass spectrometry was described. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sampling occurred in three watersheds in China. |
| | Metric 5: | Currency | Medium | Data was collected in 2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicates were collected. |
| | Metric 7: | Exposure Scenario | High | Potential sources of exposure in surface water were identified. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Raw data was provided in supplemental Excel file. |
| | Metric 9: | Quality Assurance | High | QA/QC was reported and included blanks, spiked samples, and cleaning procedures. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | No gaps nor limitations were reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Wang, I. J., Karmaus, W. J. (2015). The effect of phthalate exposure and filaggrin gene variants on atopic dermatitis. Environmental Research 136:213-218. |
| **HERO ID:** | 2718048 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Most key criteria met. Duration of sample storage prior to analysis lacking. Sampling containers not described. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Most key criteria met. Recovery of internal standard and native standard of phthalates conducted but data not provided. |
| | Metric 3: | Biomarker Selection | High | High. Sampling for metabolites specific for parent chemicals |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Taiwan. |
| | Metric 5: | Currency | Medium | Medium. Samples collected in 2010. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Medium. Single spot urine samples collected from 106 cases and 347 controls, non-statistical sampling approach. No indication of replicate sampling or analysis. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Participant characteristics reported for cases and controls for relevant exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Most key criteria met. Lack of detection frequency and raw data. |
| | Metric 9: | Quality Assurance | Medium | Medium. Most key criteria met. Lack of recovery data. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Medium. Most key criteria met, study limitations only briefly discussed. |
| **Overall Quality Determination** | | | **Medium** | |

**Study Citation:** Holmes, A. K., Koller, K. R., Kieszak, S. M., Sjodin, A., Calafat, A. M., Sacco, F. D., Varner, D. W., Lanier, A. P., Rubin, C. H. (2014). Case-control study of breast cancer and exposure to synthetic environmental chemicals among Alaska Native women. International Journal of Circumpolar Health 73(1):25760.

**HERO ID:** 2718053

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some sampling methods not described in details such as storage and handling of blood samples |
| | Metric 2: | Analytical Methodology | Low | Analytical methods not reported or described, missing LOD and limits |
| | Metric 3: | Biomarker Selection | High | acceptable biomarker |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Alaska |
| | Metric 5: | Currency | Low | Samples collected between 1999 and 2002 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples no replicates |
| | Metric 7: | Exposure Scenario | High | Alaskan native women, collection of demographic information. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | raw data not reported |
| | Metric 9: | Quality Assurance | Low | Limited QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Limitations reported |

## Overall Quality Determination Low

**Study Citation:** Vagi, S. J., Azziz-Baumgartner, E., Sjödin, A., Calafat, A. M., Dumesic, D., Gonzalez, L., Kato, K., Silva, M. J., Ye, X., Azziz, R. (2014). Exploring the potential association between brominated diphenyl ethers, polychlorinated biphenyls, organochlorine pesticides, perfluorinated compounds, phthalates, and bisphenol a in polycystic ovary syndrome: a case-control study. BMC Endocrine Disorders 14(1):86.

**HERO ID:** 2718073

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods were reported. |
| | Metric 2: | Analytical Methodology | Medium | Recovery samples not reported. |
| | Metric 3: | Biomarker Selection | High | Biomarker is acceptable. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study performed in California. |
| | Metric 5: | Currency | Medium | Samples were collected in 2007 and 2008. |
| | Metric 6: | Spatial and Temporal Variability | Low | 52 patients and 50 controls were recruited to the study. No replicates were collected and only single spot urine samples were provided. |
| | Metric 7: | Exposure Scenario | Medium | Exposure scenario not well characterized. However, note that the aim of this study was to determine if there was an association between patients with polycystic ovarian syndrome and environmental contaminants in their body. As a result, some of this metric's criteria are less applicable. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. |
| | Metric 9: | Quality Assurance | Low | Limited QA/QC techniques were reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Gaps and limitations were reported but little characterization of variance. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Fisher, M., Arbuckle, T. E., Mallick, R., Leblanc, A., Hauser, R., Feeley, M., Koniecki, D., Ramsay, T., Provencher, G., Bérubé, R., Walker, M. (2015). Bisphenol A and phthalate metabolite urinary concentrations: Daily and across pregnancy variability. Journal of Exposure Science & Environmental Epidemiology 25(3):231-239. |
| **HERO ID:** | 2718085 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Most key criteria met. Duration of sample storage prior to analysis lacking. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Most key criteria met. Lack of recovery data |
| | Metric 3: | Biomarker Selection | Low | Low. Sampling for metabolites not specific for parent chemicals. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Canada. |
| | Metric 5: | Currency | Medium | Medium. Sampling 2009-2010. |
| | Metric 6: | Spatial and Temporal Variability | High | High. Temporal variability high: 24-hour spot urine specimens collected from subjects in Ottowa during early pregnancy on weekdays (n=64 samples) and weekends (n=66 samples), followed by single spot urine specimens for each participant during 2nd (n=70 samples) and 3rd (n=71 samples) trimesters as well as postpartum (n=63 samples). |
| | Metric 7: | Exposure Scenario | Medium | Medium. Participant characteristics summarized for relevant exposure scenario. Occupation not reported. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Most key criteria met. Lack of raw data. |
| | Metric 9: | Quality Assurance | Medium | Medium. Most key criteria met. Lack of recovery data. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Medium. Most key criteria met, variability summarized within statistical summary measures, lack of robust discussion of potential study limitations. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Wiberg, B., Lind, P. M., Lind, L. (2014). Serum levels of monobenzylphthalate (MBzP) is related to carotid atherosclerosis in the elderly. Environmental Research 133:348-352. |
| **HERO ID:** | 2718093 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some key criteria met, but lack of sample storage conditions and duration of sample storage. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Lack of recovery and extraction details but analytical methodology referenced as a CDC method. LOD was reported in Results. |
| | Metric 3: | Biomarker Selection | High | Sampling for metabolites specific for parent chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected from participants in Uppsala, Sweden. |
| | Metric 5: | Currency | Low | Sampling dates were not reported. Publication date is 2014. |
| | Metric 6: | Spatial and Temporal Variability | Low | A single fasting blood sample was collected from each of n=1016 participants with no replicates. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring paper that aims to study association between exposure to BBP and atherosclerosis. Some of the parameters in this metric do not apply. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not provided. |
| | Metric 9: | Quality Assurance | Low | Quality assurance procedures not reported, but can be inferred from its use of a CDC method. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Tables only reported the relationships between MBzP and plaques rather than blood levels of MBzP; see Results text for more data points. There is a limited discussion of potential study limitations and low frequency of detection. |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | Song, M., Chi, C., Guo, M., Wang, X., Cheng, L., Shen, X. (2015). Pollution levels and characteristics of phthalate esters in indoor air of offices. Journal of Environmental Sciences 28:157-162. |
| **HERO ID:** | 2804025 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some sampling methods not reported, such as storage conditions and calibration of the sample |
| | Metric 2: | Analytical Methodology | High | The sample was analyzed by a gas chromatograph (FULI 9790, Wenling, China) with a DB-5 capillary column (30 m × 0.25 mm ID × 0.25 $\mu$m, Agilent Technology Inc, America). |
| | Metric 3: | Biomarker Selection | N/A | NA - Particle samples no biomarker needed. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Hangzhou, China |
| | Metric 5: | Currency | Medium | Data collected in 2013 |
| | Metric 6: | Spatial and Temporal Variability | High | Ten offices, 8-10 hr sampling for air and 1-2 hr sampling for particulate. |
| | Metric 7: | Exposure Scenario | Medium | Workplace and offices. Could be useful for home office scenarios. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | raw data not provided |
| | Metric 9: | Quality Assurance | Medium | Done but not reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Wu, W., Hu, J., Wang, J., Chen, X., Yao, N., Tao, J., Zhou, Y. K. (2015). Analysis of phthalate esters in soils near an electronics manufacturing facility and from a non-industrialized area by gas purge microsyringe extraction and gas chromatography. Science of the Total Environment 508:445-451. |
| **HERO ID:** | 2804032 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | Samples collected in 2013 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | High | Exposure source characterized. Soil samples around source and removed from source |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported |
| | Metric 9: | Quality Assurance | Medium | QA/QC described, but still missing some aspects like field blanks (sampling, transportation) or any mention of addressing these aspects. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability between sampling locations discussed. Uncertainty to the measurements in soil samples was not recognized. Soil have some of the largest variability and hence uncertainties due to the complexities of the media. This needed to be addressed, described, and recognized better. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Zhang, Y., Wang, P., Wang, L., Sun, G., Zhao, J., Zhang, H., Du, N. (2015). The influence of facility agriculture production on phthalate esters distribution in black soils of northeast China. Science of the Total Environment 506-507:118-125. |
| **HERO ID:** | 2804035 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most sampling methods reported, except some details were missing (e.g., sampling equipment, storage conditions). |
| | Metric 2: | Analytical Methodology | High | Key analytical methods (e.g., extraction methods, GC-MS analysis) were reported. MDLs provided in text under Section 2.6. |
| | Metric 3: | Biomarker Selection | N/A | The study tested for parent chemicals in soil. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected from nine cities in China. |
| | Metric 5: | Currency | Medium | Samples were collected in 2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | There were a total of 27 samples collected with no replicates. |
| | Metric 7: | Exposure Scenario | High | Exposure scenario was characterized, including possible sources of exposure (i.e., via contaminated agricultural soil). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics were provided but not raw data. |
| | Metric 9: | Quality Assurance | High | QA/QC techniques were described and included procedural blank, spike blank, sample duplicates, and recoveries. Recovery ranges were acceptable. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Key gaps and limitations were not discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Huang, Y., Lu, W. W., Chen, B., You, J., Wu, M., Li, S. G. (2014). Phthalates in commercial chinese rice wines: concentrations and the cumulative risk assessment to adult males in shanghai. Biomedical and Environmental Sciences 27(10):819-823. |
| **HERO ID:** | 2804038 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Several sampling methods not reported such as sample storage conditions and sampler calibration |
| | Metric 2: | Analytical Methodology | Medium | Some analytical methods not reported such as instrument calibration |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Shanghai, China |
| | Metric 5: | Currency | Medium | Study conducted in 2014 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | Medium | Consumption of rice wine, may be applicable to certain demographic groups within general population. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | raw data not reported |
| | Metric 9: | Quality Assurance | Low | Limited QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Few gaps and limitations reported |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Xu, Y., Liang, Y., Urquidi, J. R., Siegel, J. A. (2014). Phthalates and polybrominated diphenyl ethers in retail stores. Atmospheric Environment 87:53-64. |
| **HERO ID:** | 2804046 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The study reports two sampling approaches indicating sample procedures, equipment, and storage. |
| | Metric 2: | Analytical Methodology | Low | Analytical methods described in detail, and detection limits were discussed but not reported. |
| | Metric 3: | Biomarker Selection | N/A | The study reports the parent compound in indoor air. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Texas and Pennsylvania, USA. |
| | Metric 5: | Currency | Low | Timing for sample collection is not reported, but paper's publication date is 2013. |
| | Metric 6: | Spatial and Temporal Variability | High | Twelve retail stores were sampled, and more than one sample was collected at some stores. Duplicate air samples were collected for 48 h to a total volume of 72 m3, and a field blank was prepared at each sampling location. |
| | Metric 7: | Exposure Scenario | High | The study measured the indoor air quality in retail environments. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual sample concentrations are not reported. Table 3 provided the mean, SD, and range for indoor air concentrations and whole building emission rates. |
| | Metric 9: | Quality Assurance | High | The study reported field blanks and analytical recovery efficiencies. While recoveries were reported as a range for chemical types combined, the lower bound is still above 70%. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | The study reported standard deviations, concentration uncertainty (Supporting Information) and potential limitations. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Vandermarken, T., De Galan, S., Croes, K., Van Langenhove, K., Vercammen, J., Sanctorum, H., Denison, M. S., Goeyens, L., Elskens, M., Baeyens, W. (2016). Characterisation and implementation of the ERE-CALUX bioassay on indoor dust samples of kindergartens to assess estrogenic potencies. Journal of Steroid Biochemistry and Molecular Biology 155(Pt B):182-189. |
| **HERO ID:** | 2807610 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Dust samples were collected in 12 kindergarten classrooms in Belgium. Used a vacuum cleaner with a phthalate free glass fiber thimble in addition to other teflon and stainless steel parts to avoid contamination. Vacuum was set to collect 2cm above the ground to avoid scraping floors. Collected approx. 250 mg of dust after 2 min of 1m square surface. Classroom interior was documented and reported. |
| | Metric 2: | Analytical Methodology | High | This study was about comparing sample collection to a bioassay technique. We are interested in the collected dust samples. The collected dust samples were extracted using EPA method 3620c and analyzed via gas chromatography mass spectrometry. Internal standards, blanks, and LODs reported. Details of analysis and extraction reported in their own sections. |
| | Metric 3: | Biomarker Selection | N/A | NA - Dust samples no biomarker needed. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Flanders and Brussels, Belgium |
| | Metric 5: | Currency | Low | Sampling date not specified, publication date 2016. |
| | Metric 6: | Spatial and Temporal Variability | Medium | One sample in 12 locations, no replicate. |
| | Metric 7: | Exposure Scenario | High | Children indoor environment and dust concentrations. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 4 concentrations in dust. Blank corrected, so no raw data provided. |
| | Metric 9: | Quality Assurance | High | Analytical QA/QC was reported and is reliable. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Sources of variability and uncertainty between the two approaches were discussed, also discussed the various classroom content and potential sources of variability and uncertainty. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Just, A. C., Miller, R. L., Perzanowski, M. S., Rundle, A. G., Chen, Q., Jung, K. H., Hoepner, L., Camann, D. E., Calafat, A. M., Perera, F. P., Whyatt, R. M. (2015). Vinyl flooring in the home is associated with children's airborne butylbenzyl phthalate and urinary metabolite concentrations. Journal of Exposure Science & Environmental Epidemiology 25(6):574-579. |
| **HERO ID:** | 2816367 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Most key criteria met. Duration of sample storage prior to analysis lacking for air and urine samples. |
| | Metric 2: | Analytical Methodology | Low | Low. Medium. Some key criteria met. Lack of recovery data and LOD. |
| | Metric 3: | Biomarker Selection | High | High. Sampling for metabolites specific for parent chemical (urine) and samples for parent chemicals (air). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. New York City. |
| | Metric 5: | Currency | Medium | Medium. Enrollment 1998-2006. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Medium. Spot urine samples collected at beginning and end of two weeks of air sampling for each of 239 participants. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Participant characteristics reported for relevant non-occupational exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Most key criteria met. Lack of raw data. |
| | Metric 9: | Quality Assurance | Low | Low. Quality assurance procedures not discussed, frequency of detection reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Medium. Statistical summary measures report concentration variability, lack of robust discussion of potential study limitations. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Li, T., Yin, P., Zhao, L., Wang, G., Yu, Q. J., Li, H., Duan, S. (2015). Spatial-temporal distribution of phthalate esters from riverine outlets of Pearl River Delta in China. Water Science and Technology 71(2):183-190. |
| **HERO ID:** | 2816369 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | water and sediment samples collected from 7 outlets during January and April (fig 1); surface water from top 0-50cm collected in stainless steel barrel and stored in glass; sediment taken using gravity corer and sliced at 5-10cm intervals; all samples conducted in triplicate; 1L water filtered; sediment air-dried, ground, and homogenized |
| | Metric 2: | Analytical Methodology | High | extraction discussed on p.185; GC-MS; LOD was 0.010 ug/L for water and 0.008 ug/g for sediment; recoveries reported. |
| | Metric 3: | Biomarker Selection | N/A | Water and sediment sampling |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Pearl River Delta (PRD) in China |
| | Metric 5: | Currency | Medium | 2013 |
| | Metric 6: | Spatial and Temporal Variability | High | 7 riverine outlets sampled during dry and wet season; all sampling conducted in triplicate |
| | Metric 7: | Exposure Scenario | High | surface water and sediments of a river delta in China contaminated by various industrial chemicals from local industries |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Table 1 provides concentration is surface water for each sampling site in both wet and dry season; range, mean, and DF provided; Table 3 provides concentration the mean, range, and DF of the 7 outlets combined in total as well as wet and dry season; Table 4 provides the individual sediment concentrations per site by depth in wet season |
| | Metric 9: | Quality Assurance | High | procedural blank, a spiked blank, a matrix-spiked, a sample duplicate and a solvent blank were processed every 10 field samples; recoveries ranged from 76.3-106% |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | compared spatial-temporal distribution; compared findings to those measured in other regions of the world |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Wei, X., Gu, P., Zhang, G., Huang, J. (2015). Occurrence of emerging and priority pollutants in municipal reverse osmosis concentrates. Environmental Science: Processes & Impacts 17(2):488-494. |
| **HERO ID:** | 2816370 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The sampling methods were described in detail. |
| | Metric 2: | Analytical Methodology | High | Analytical methods were sufficiently described. LOD was reported in Table 2. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in environment. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Tianjin, China. |
| | Metric 5: | Currency | Medium | Samples were collected in 2011-2013 |
| | Metric 6: | Spatial and Temporal Variability | Low | There were 4 samples collected. There were no replicates mentioned. |
| | Metric 7: | Exposure Scenario | Medium | The sources of exposures were explained and measured in wastewater treatment. There was little information on the population of exposure. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Tables 2 and 4 report individual concentrations. Only a few summary statistics were reported. |
| | Metric 9: | Quality Assurance | High | The QC techniques were explained in detail. They discussed recoveries and blanks. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Limitations and uncertainties were not discussed. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Dodson, R. E., Camann, D. E., Morello-Frosch, R., Brody, J. G., Rudel, R. A. (2015). Semivolatile organic compounds in homes: strategies for efficient and systematic exposure measurement based on empirical and theoretical factors. Environmental Science & Technology 49(1):113-122. |
| **HERO ID:** | 2816371 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling equipment and methods are reported in detail and scientifically sound. |
| | Metric 2: | Analytical Methodology | High | Analytical instrumentation and methods are reported in detail and scientifically sound. Method reporting limit calculation is based off of analytical detection limit, which is reported in the supplementary information. |
| | Metric 3: | Biomarker Selection | N/A | This study is testing for the parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was performed in California. |
| | Metric 5: | Currency | Medium | Samples were collected in 2006. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 49 dust and indoor and outdoor air samples were collected from 50 homes in California without replicates. |
| | Metric 7: | Exposure Scenario | Medium | Dust samples were collected from common exposure sites (rugs, upholstery, wood floors, windowsills, ceiling fans, and furniture) in the primary living area of residential homes. Additional information about study communities is available in other publications, although there is little mention of potential product/chemical use in the sampled homes. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics reported include percent of samples above method reporting limit, median, 95th percentile, and maximum concentration of compound of interest in dust. Individual sample concentrations are not reported. |
| | Metric 9: | Quality Assurance | High | QA/QC measures included use of blanks, split-sample duplicates, and measures of spike recovery, which ranged from 78-108% |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | The characterization of variability is absent. However, authors discuss the limitations presented by various approaches to measurement of household exposures to semivolatile organic compounds |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Yang, G. C. C., Wang, C. L., Chiu, Y. (2015). Occurrence and distribution of phthalate esters and pharmaceuticals in Taiwan river sediments. Journal of Soils and Sediments 15(1):198-210. |
| **HERO ID:** | 2816375 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods were briefly summarized with reference to Taiwan's NIEA S102.61B standard method. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported (e.g., sample extraction using NIEA M167.01C standard method, spiked and blank smaples, recovery, LC-ESI-MS/MS analytical methods, instruments). |
| | Metric 3: | Biomarker Selection | N/A | Study tested parent chemicals in river sediment. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study performed in Dianbao River, Taiwan. |
| | Metric 5: | Currency | Medium | Samples collected in 2011 to 2012. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 35 samples were collected with no replicates. |
| | Metric 7: | Exposure Scenario | Medium | Exposure scenario is not well characterized, other than some information on pollutant sources (i.e., factories along its flow and their products). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. Most summary statistics are missing except for average concentrations and detection frequencies. |
| | Metric 9: | Quality Assurance | High | QA/QC reported with acceptable recovery. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variance characterized with standard deviation, but limitations, data gaps, and uncertainties were not described. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Bae, J., Kim, S., Kannan, K., Buck Louis, G. M. (2015). Couples' urinary bisphenol A and phthalate metabolite concentrations and the secondary sex ratio. Environmental Research 137:450-457. |
| **HERO ID:** | 2816865 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | population described, urine sampling not described |
| | Metric 2: | Analytical Methodology | Medium | LOD range provided. published methods (Guo et al., 2011; Zhang et al., 2011) |
| | Metric 3: | Biomarker Selection | High | metabolite in urine |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Michigan and Texas |
| | Metric 5: | Currency | Medium | 2005 and 2009 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 213 mothers and n = 212 fathers, no replicates |
| | Metric 7: | Exposure Scenario | High | biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | geometric mean and 95%CI |
| | Metric 9: | Quality Assurance | Medium | quality assurance and control procedures included in published methods (Guo et al., 2011; Zhang et al., 2011) |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | variability briefly discussed, uncertainty not discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Robledo, C. A., Peck, J. D., Stoner, J., Calafat, A. M., Carabin, H., Cowan, L., Goodman, J. R. (2015). Urinary phthalate metabolite concentrations and blood glucose levels during pregnancy. International Journal of Hygiene and Environmental Health 218(3):324-330. |
| **HERO ID:** | 2816868 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methods, equipment, storage reported. |
| | Metric 2: | Analytical Methodology | Medium | Extraction methods, analytical methods and equipment reported. Recovery samples and calibration not reported. |
| | Metric 3: | Biomarker Selection | High | Metabolite derived from parent chemical (MBzP). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Oklahoma |
| | Metric 5: | Currency | Medium | Samples collected in 2008 |
| | Metric 6: | Spatial and Temporal Variability | Low | 110 samples. No replicates. Spot urine samples. |
| | Metric 7: | Exposure Scenario | High | Measuring exposure in pregnant women. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Only geometric mean and percentiles reported. Raw data not provided. |
| | Metric 9: | Quality Assurance | Low | QA not reported but can be implied. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Gaps and limitations reported. No measure of variability. |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | Chen, C. Y., Chou, Y. Y., Lin, S. J., Lee, C. C. (2015). Developing an intervention strategy to reduce phthalate exposure in Taiwanese girls. Science of the Total Environment 517C:125-131. |
| **HERO ID:** | 2816869 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methods included equipment and collecting first morning spot urine pre- and post-intervention. Participants characteristics were not described in detail, but cited a previous study (Chen et al., 2013) where participants were re-enrolled from. |
| | Metric 2: | Analytical Methodology | High | Extraction, equipment, LOD, and other details were reported. |
| | Metric 3: | Biomarker Selection | High | MBzP is a metabolite specific to BBP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was performed in Taiwan. |
| | Metric 5: | Currency | Medium | Study was done in 2010. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Samples were collected from 30 participants without replicates. First morning voids were also collected. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. |
| | Metric 9: | Quality Assurance | Medium | There was some but not a robust report of QA/QC. Authors described that one blank and one quality control (QC) sample were included in each batch. Recovery for metabolites spiked into artificially pooled urine ranged from 82-131%. For 13C-labeled internal standard of each monoester, the recovery was only reported as >40% for all monoesters. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | There was a limited characterization of variance and no discussion of uncertainties or data gaps. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Tran, T. M., Kannan, K. (2015). Occurrence of phthalate diesters in particulate and vapor phases in indoor air and implications for human exposure in Albany, New York, USA. Archives of Environmental Contamination and Toxicology 68(3):489-499. |
| **HERO ID:** | 2816872 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling method, matrix, equipment, and storage were described. |
| | Metric 2: | Analytical Methodology | Medium | GC/MS was used to analyze the samples. MDL and MQL were determined and reported in the SI, but SI is not available. Text provides a range for all chemicals analyzed. |
| | Metric 3: | Biomarker Selection | N/A | Study tested for parent chemicals in indoor air. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was performed in Albany, NY. |
| | Metric 5: | Currency | Medium | Samples were collected in 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Samples were collected in 6 categories and each category has 6 to 20 data points. No replicates were collected. |
| | Metric 7: | Exposure Scenario | High | The data represents a relevant exposure scenario (indoor air in homes, offices, schools, labs, schools, salons, and some public places). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Mean concentrations were reported with summary statistics. No individual data were reported. |
| | Metric 9: | Quality Assurance | High | QA/QC were performed and no major concerns were seen. Recoveries were above 90% for PUFs and above 82% for the glass fiber filter. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | There is a limited discussion of uncertainties, limitations, and data gaps. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Bao, J., Zeng, X. W., Qin, X. D., Lee, Y. L., Chen, X., Jin, Y. H., Tang, N. J., Dong, G. H. (2015). Phthalate metabolites in urine samples from school children in Taipei, Taiwan. Archives of Environmental Contamination and Toxicology 69(2):202-207. |
| **HERO ID:** | 2823270 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Spot urine samples; collected in polypropylene tubes and stored at -20 C until analysis. 225 children selected from pool of ”control” school children for a cohort study of asthma. Collection not described. |
| | Metric 2: | Analytical Methodology | High | Deconjugation followed by SPE and HPLC-MS/MS, thoroughly described; radiolabeled internal standards; creatinine also measured. LOD for MBzP 0.1 ng/mL. |
| | Metric 3: | Biomarker Selection | High | MBzP in urine as biomarker of BBzP exposure. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Taiwan, Taipei |
| | Metric 5: | Currency | Medium | 2009 to 2010 |
| | Metric 6: | Spatial and Temporal Variability | Low | Single spot urine samples from 225 healthy school children, 102 males and 123 females, ages 12 through 15 years. |
| | Metric 7: | Exposure Scenario | Low | All sources of exposures; possible exposure scenarios not evaluated. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Reported frequency of detection (MBzP=86%); concentrations corrected and uncorrected (for creatinine); mean, median, 25th, and 75th percentiles (Table 2) and min and max (text). |
| | Metric 9: | Quality Assurance | High | Procedural and solvent blanks included; duplicate injections and calibration check standards (after every 20 samples); extraction blanks indicated no contamination above LOD; recoveries reported by metabolite (>60%); same urine analyzed in 9 batches to determine precision and accuracy. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited discussion of uncertainties; compared results with those from studies in other countries. Variance depicted by presenting quartiles. |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | Bekö, G., Callesen, M., Weschler, C. J., Toftum, J., Langer, S., Sigsgaard, T., Høst, A., Kold Jensen, T., Clausen, G. (2015). Phthalate exposure through different pathways and allergic sensitization in preschool children with asthma, allergic rhinoconjunctivitis and atopic dermatitis. Environmental Research 137:432-439. |
| **HERO ID:** | 2823294 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | The sampling methodology was outlined and seemed high-quality, but specific details were lacking in this paper (though covered in depth in other papers). |
| | Metric 2: | Analytical Methodology | Low | Analytical methods were described in a previous publication and are not summarized. They mention assuming non-detects were half the limits of detection but do not identify individual LODs. |
| | Metric 3: | Biomarker Selection | Low | Metabolites of phthalates were measured in urine (and the parent phthalates were analyzed in dust). One of these metabolites could be a metabolite of either DBP or BBP; no effort was made to apportion it. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Denmark |
| | Metric 5: | Currency | Medium | The study began in 2008 and was submitted for publication in 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | There were 200 study participants with allergic conditions and 166 controls. Duplicates of both dust and urine samples were analyzed. Urine samples were first-morning voids, so assigned this metric as medium. |
| | Metric 7: | Exposure Scenario | High | Data closely represent a relevant exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Only summary statistics are provided - medians and means. Even in the supplementary files, there are no raw data, ranges, standard deviations, etc. The narrative and a footnote to the table say there were 166 controls, but the table then lists n=164 controls, a possible minor error. Consult the other papers associated with this study for more detailed data, particularly:(1) Callesen, M., Bekö, G., Weschler, C.J., Sigsgaard, T., Jensen, T.K., Clausen, G., et al., 2014a. Associations between selected allergens, phthalates, nicotine, PAHs and bedroom ventilation and clinically confirmed asthma, rhinoconjunctivitis and atopic dermatitis in preschool children. Indoor Air 24 (2), 136–147. (2) Callesen, M., Bekö, G., Weschler, C.J., Langer, S., Brive, L., Clausen, G., et al., 2014b. Phthalate metabolites in urine and asthma, allergic rhinoconjunctivitis and atopic dermatitis in preschool children. Int. J. Hyg. Environ. Health 217, 645–652. |
| | Metric 9: | Quality Assurance | Low | Blanks were analyzed, but there are no details regarding QA/QC in this paper. It was discussed in one of the prior papers that further elaborated on methods. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | There was a brief discussion of a few uncertainties/limitations. The only discussion of variability was the comment that the data suggest that associations between phthalate exposures and allergic sensitization among children with allergic symptoms may be more pronounced in the non-healthy children. |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | Gong, M., Weschler, C. J., Liu, L., Shen, H., Huang, L., Sundell, J., Zhang, Y. (2015). Phthalate metabolites in urine samples from Beijing children and correlations with phthalate levels in their handwipes. Indoor Air 25(6):572-581. |
| **HERO ID:** | 2823304 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Parents were asked to collect their children's first morning urine in a 60 ml pre-cleaned brown glass jar on the day after handwipe sampling and then store the sample in a freezer before the investigators' visit. After transporting the urine samples to the laboratory on ice, they were stored at 36°C until analysis. |
| | Metric 2: | Analytical Methodology | Medium | Analytical methods used a method modified from Silva et al. (2007) and described in our previous study (Liu et al., 2012). |
| | Metric 3: | Biomarker Selection | Medium | Metabolite known to be derived from parent chemical (MBzP, MnBP). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | Samples collected in 2013 and 2014 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 67 samples. No replicates. Morning urine samples. |
| | Metric 7: | Exposure Scenario | High | Looking at association between phthalate exposure in children handwipes and children urine. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported. Summary statistics (mean, min, max) reported. |
| | Metric 9: | Quality Assurance | Medium | QA not directly discussed, but Fudan University's Ethical Review Board approved the study protocol prior to collection of allhandwipe and urine samples (IRB00002408 and 573 Phthalates in handwipes; metabolites in urine FWA00002399). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability in seasons measured and results compared to other studies. No gaps and limitations reported. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Khalil, M. M. H., Gomaa, A. M., Sebaei, A. S., Moustapha, N. M. (2014). Distribution of phthalate esters in Egyptian edible oil. Journal of Essential Oil Bearing Plants 17(6):1343-1351. |
| **HERO ID:** | 2823325 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling methods only reported the total number of samples and collection date. There is no information about equipment, procedure, regimen, storage, etc. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported, including extraction method, instrumentation, GC-MS, calibration, and LOD/LOQ in Table 1. |
| | Metric 3: | Biomarker Selection | N/A | Study tested for parent compounds in food. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted in Egypt. |
| | Metric 5: | Currency | Medium | Samples were collected in 2013 and 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | A total of 27 samples were collected with no replicates. |
| | Metric 7: | Exposure Scenario | High | Exposure to phthalates migrated from food packing materials to the food inside is relevant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Raw data were not reported. Summary statistics are missing. There is no concentration data, only detection frequency in Figure 4. |
| | Metric 9: | Quality Assurance | Low | There is limited QA/QC reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Uncertainties are reported, but no characterization of variance. |

## Overall Quality Determination Medium

**Study Citation:** Agay-Shay, K., Martinez, D., Valvi, D., Garcia-Esteban, R., Basagaña, X., Robinson, O., Casas, M., Sunyer, J., Vrijheid, M. (2015). Exposure to Endocrine-Disrupting Chemicals during Pregnancy and Weight at 7 Years of Age: A Multi-pollutant Approach. Environmental Health Perspectives 123(10):1030-1037.

**HERO ID:** 2854577

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Enrollment described. Study protocol was not described but cited as provided elsewhere (Guxens et al. 2012). |
| | Metric 2: | Analytical Methodology | Low | Table 1 attempted to describe LOD, but overall was not informative. |
| | Metric 3: | Biomarker Selection | High | Metabolites are specific to BBP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was performed in Spain. |
| | Metric 5: | Currency | Low | Samples were collected between 2004 and 2006. |
| | Metric 6: | Spatial and Temporal Variability | Medium | There were 470 samples but no replicates. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring where (prental) exposure has occurred. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 1 shows GM, mean, max, and min. Raw data were not provided. |
| | Metric 9: | Quality Assurance | Low | QA/QC was not discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | There was a limited characterization of variance (through range) and no discussion of uncertainties, gaps, or limitations. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Yang, L., Cheng, S., Wu, Z. (2009). Anthropogenic organic contaminants in water and surface sediments of large shallow eutrophic Chaohu Lake, China. Fresenius Environmental Bulletin 18(11):2052-2058. |
| **HERO ID:** | 2868264 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Figure 1 maps the sampling locations. Water was collected in glass bottles. Surface sediment were collected in a grab sampler at the same position as the water samples. Water and sediment samples were stored at 4C and -20C, respectively. Water samples were filtered; sediment was freeze-dried, pulverized, and finer fraction was homogenized. |
| | Metric 2: | Analytical Methodology | High | SPE and Soxhlet extraction for water and surface sediment samples, respectively. GC-MS was conducted for analysis. Recoveries and detection limits (0.02ng/L and 0.015ng/g dry weight for water and sediment, respectively) were reported in text. |
| | Metric 3: | Biomarker Selection | N/A | Study tested parent chemicals in lake water and sediment. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study performed in Chaohu Lake, China. |
| | Metric 5: | Currency | Medium | Samples were collected in 2007. |
| | Metric 6: | Spatial and Temporal Variability | Low | Seven sites were selected for sampling, where it appears that a single/grab water and sediment sample was collected per site in a one day. No replicate samples were not reported. |
| | Metric 7: | Exposure Scenario | High | Exposure scenario is relevant. Study measured chemical concentrations in the water and sediment of the fifth largest freshwater lake in China that is important for municipal and industrial use, irrigation, flood prevention, shipping, fishery, and tourism. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Tables 3 and 4 provide raw data for each sampling site. However, summary statistics are missing. |
| | Metric 9: | Quality Assurance | Medium | QA/QC techniques reported on pg 2054 that included procedural blanks and recoveries. Recoveries were reported as a range for spiked water and sediment samples. The lower bound of the range is <70% for both, and authors noted that the results were revised with recoveries. However, no details were provided about how they were revised. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | There is no characterization of variance, but the range can be easily determined given the presence of raw data and small sample size. There is no discussion of limitations, uncertainties, and gaps either. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Philippat, C., Bennett, D. H., Krakowiak, P., Rose, M., Hwang, H. M., Hertz-Picciotto, I. (2015). Phthalate concentrations in house dust in relation to autism spectrum disorder and developmental delay in the CHildhood Autism Risks from Genetics and the Environment (CHARGE) study. Environmental Health 14(1):56. |
| **HERO ID:** | 2914664 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling equipment and methods are sufficiently described, but certain details such as duration of sample storage are missing (unlikely to have a substantial impact on results). |
| | Metric 2: | Analytical Methodology | Low | Analytical instrumentation and methods are sufficiently described, but limit of detection is not reported. |
| | Metric 3: | Biomarker Selection | N/A | The study tested for the parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted in California. |
| | Metric 5: | Currency | Medium | Children were eligible if enrolled during 2010-2011, or before 2010 and under 60 months at the time of enrollment. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Dust samples were collected from 145 homes with no replicates. |
| | Metric 7: | Exposure Scenario | High | Samples were collected from carpet or rugs in the main living area of homes in California. The types of flooring in each room of the homes were considered in exposure assessment. No other possible exposure sources were evaluated, but that was beyond the aim of the study. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics for compound concentration included the percent of samples with detectable levels and percentiles of exposure (5th, 25th, 50th, 75th, 95th). Individual sample concentrations were not reported. |
| | Metric 9: | Quality Assurance | Low | Quality assurance/quality control techniques and results were not directly discussed, but can be implied through the study's use of standard field and laboratory protocols |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Statistical characterization of variability was not reported, but there is some discussion of key uncertainties and limitations in results. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Myridakis, A., Fthenou, E., Balaska, E., Vakinti, M., Kogevinas, M., Stephanou, E. G. (2015). Phthalate esters, parabens and bisphenol-A exposure among mothers and their children in Greece (Rhea cohort). Environment International 83:10-Jan. |
| **HERO ID:** | 2914665 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Well-described sampling methodology, scientifically sound. |
| | Metric 2: | Analytical Methodology | High | Detailed analytical methods, reported LOD, described recoveries. |
| | Metric 3: | Biomarker Selection | High | Biomarker is known to be related to external exposure to phthalates. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Greece |
| | Metric 5: | Currency | Low | Sampling began in 2007. |
| | Metric 6: | Spatial and Temporal Variability | Low | n=478 in total, no replicates. |
| | Metric 7: | Exposure Scenario | High | Data closely represent relevant exposure scenarios related to phthalates. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics (mean, geometric mean, median, range, 95th percentile). |
| | Metric 9: | Quality Assurance | High | Well described QA/QC techniques. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Characterized variability, limited discussion of uncertainties and limitations. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Tran, B. C., Teil, M. J., Blanchard, M., Alliot, F., Chevreuil, M. (2015). Fate of phthalates and BPA in agricultural and non-agricultural soils of the Paris area (France). Environmental Science and Pollution Research 22(14):11118-11126. |
| **HERO ID:** | 2914670 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sample locations and WWTP characteristics were described. Sludge was sampled from a storage area and kept at -18°C. Appendix contains additional information on sampling timing. Soil and sludge were freeze-dried for 3 days, homogenized, and sieved. |
| | Metric 2: | Analytical Methodology | High | Authors described extraction procedures (extracted with 15mL of mixture of hexane 50 vol/acetone 50 vol in a Bransonic 2510 ultra-sonic bath (VWR) for 20 min), analytical methods (GC/MS), recoveries (Appendix 5), and LOD/LOQ (Appendix 5). |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in sewage sludge. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study performed in Essonne, France. |
| | Metric 5: | Currency | Medium | Samples were collected in 2010-2011 and then 2012. |
| | Metric 6: | Spatial and Temporal Variability | Low | The number of sludge samples was not defined. Four sampling events were conducted in 2010-2011 after a single sludge application. Samples were collected at four different depths during each event and presumably one sample was taken at each depth. A second sampling campaign occurred in 2012 for only surface soil where five samples were collected. There was no mention of replicates for any of them. |
| | Metric 7: | Exposure Scenario | High | The concentration in sewage sludge from WWTP receiving wastewater from domestic and hospital were determined. This sludge was then applied to agricultural soil and chemical concentrations were compared with those of urban, rural, and forestry soils. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Figures and tables provide mean levels; raw data were not provided. |
| | Metric 9: | Quality Assurance | High | Recoveries ranged from 55-106% and were corrected by procedural blanks, as reported in Appendix 5. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | There was limited to no characterization of variance and some characterization of uncertainty in Appendix 5. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Zhang, Y., Cao, Y., Shi, H., Jiang, X., Zhao, Y., Fang, X., Xie, C. (2015). Could exposure to phthalates speed up or delay pubertal onset and development? A 1.5-year follow-up of a school-based population. Environment International 83:41-49. |
| **HERO ID:** | 2915540 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some information missing, such as location of samples taken. |
| | Metric 2: | Analytical Methodology | Medium | Extraction methods, analytical instrument (ESI-MS/MS), LOD reported as a range. Calibration and recovery information missing. |
| | Metric 3: | Biomarker Selection | High | Metabolite is known to be related with parent chemical (MnBP). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | Sampling in 2011 |
| | Metric 6: | Spatial and Temporal Variability | Low | n=500 at baseline (430 at follow-up). No replicates. Spot urine samples. |
| | Metric 7: | Exposure Scenario | High | Biomonitoring in school aged boys and girls. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Only geometric means reported. |
| | Metric 9: | Quality Assurance | Low | QA/QC techniques were not described but can be implied through the study's methods. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability was characterized in different concentrations in boys and girls. Uncertainties and limitations were discussed. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Dallongeville, A., Costet, N., Zmirou-Navier, D., Le Bot, B., Chevrier, C., Deguen, S., Annesi-Maesano, I., Blanchard, O. (2016). Volatile and semi-volatile organic compounds of respiratory health relevance in French dwellings. Indoor Air 26(3):426-438. |
| **HERO ID:** | 2918731 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Supporting Information available in online version of article and in Mercier et al. (2014). |
| | Metric 2: | Analytical Methodology | High | PLE extraction; GC/MS (Mercier et al. 2014), calibration. |
| | Metric 3: | Biomarker Selection | N/A | Paper measures concentration of parent compound in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | France, western; Brittany. |
| | Metric 5: | Currency | Medium | September 2012 to October 2013. |
| | Metric 6: | Spatial and Temporal Variability | High | 150 homes; 81 sampled cold season; 69 sampled hot season. Living room air continuously collected over 5 days for total of 14 m3 per dwelling. |
| | Metric 7: | Exposure Scenario | High | Indoor air; living room; single family homes with children. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Reported n, LOQ, detection frequency, mean, median, max, min, and 10th and 90th percentiles. |
| | Metric 9: | Quality Assurance | High | Field blanks, lab blanks, five calibration solutions per compound. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Limitation of one 5-day sampling event per dwelling discussed; influence of other factors evaluated. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Stelmach, I., Majak, P., Jerzynska, J., Podlecka, D., Stelmach, W., Polańska, K., Ligocka, D., Hanke, W. (2015). The effect of prenatal exposure to phthalates on food allergy and early eczema in inner-city children. Allergy and Asthma Proceedings 36(4):72-78. |
| **HERO ID:** | 2919070 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Spot urine samples were collected into polyethylene cups and stored at-20°C until analysis, which was performed at Nofer Institute of Occupational Medicine, Lodz, Poland. Reference was included for complete reporting on recruitment and follow-up procedures. |
| | Metric 2: | Analytical Methodology | Low | Phthalate metabolites in urine were determined by the use of High Performance Liquid Chromatography with tandem mass spectrometry system. LODs or LOQs were not reported |
| | Metric 3: | Biomarker Selection | High | BBzP is a specific metabolite of BBP/BBzP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was performed in Poland. |
| | Metric 5: | Currency | Medium | Samples were collected in 2007. |
| | Metric 6: | Spatial and Temporal Variability | Medium | There were 147 participants, and no replicates were reported. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study that assumes exposure occurred. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data points were not reported. |
| | Metric 9: | Quality Assurance | Low | QA/QC techniques were not thoroughly discussed. Authors mentioned that they obtained two control urine samples from Consortium to Perform Human Biomonitoring on a European Scale, Work Package 3. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Key limitations reported. Variance reported as percentiles. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Net, S., Dumoulin, D., El-Osmani, R., Rabodonirina, S., Ouddane, B. (2014). Case study of PAHs, Me-PAHs, PCBs, phthalates and pesticides contamination in the Somme river water, France. International Journal of Environmental Research 8(4):1159-1170. |
| **HERO ID:** | 2932024 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Pertinent sampling procedures were described (e.g., site and matrix characteristics, equipment, storage conditions). |
| | Metric 2: | Analytical Methodology | Low | There were limited information on instrument calibration and no LOD/LOQs. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in surface water. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in France. |
| | Metric 5: | Currency | Medium | Samples were collected in 2012. |
| | Metric 6: | Spatial and Temporal Variability | Medium | There were 11 sampling sites along the river in addition to two nearby ponds. Replicates were not reported. |
| | Metric 7: | Exposure Scenario | Medium | Data are likely to represent a exposure scenario, but there is limited description of the population or microenvironment of interest. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data points were provided but most summary statistics were missing. |
| | Metric 9: | Quality Assurance | Low | There was some discussion about blanks and recoveries, but information on QA/QC is very limited overall. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | There was no discussion of uncertainties and limitations. The main text discussed ranges for the characterization of variance, and the raw data allow for separate computation if necessary. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Gascon, M., Valvi, D., Forns, J., Casas, M., Martínez, D., Júlvez, J., Monfort, N., Ventura, R., Sunyer, J., Vrijheid, M. (2015). Prenatal exposure to phthalates and neuropsychological development during childhood. International Journal of Hygiene and Environmental Health 218(6):550-558. |
| **HERO ID:** | 2965922 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Most key criteria met, project methodology referenced; lack of duration of sample storage data and equipment used. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Most key criteria met. The LOD for the different congeners ranged from 0.5 to 1 g/L (further details for methodology referenced in Valvi et al., 2015). |
| | Metric 3: | Biomarker Selection | Medium | Sampling for MBzP and MnBP is measured as a sum of four DEHP metabolites. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Samples provided by participants in a hospital in Spain. |
| | Metric 5: | Currency | Medium | Low. Samples collected 2004-2006. |
| | Metric 6: | Spatial and Temporal Variability | Low | Medium. Two spot urine specimens provided by each participant at 12 and 32 weeks gestation for n=657 participants. |
| | Metric 7: | Exposure Scenario | High | Exposure to children. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Only provides 95% CI. Lack of raw data and other summary statistics. |
| | Metric 9: | Quality Assurance | Low | Low. Quality assurance parameters not reported, however study methods referenced. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Medium. Variability characterized within exposure concentration result summary statistics, robust discussion of potential study limitations and uncertainties. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Shapiro, G. D., Dodds, L., Arbuckle, T. E., Ashley-Martin, J., Fraser, W., Fisher, M., Taback, S., Keely, E., Bouchard, M. F., Monnier, P., Dallaire, R., Morisset, A. S., Ettinger, A. S. (2015). Exposure to phthalates, bisphenol A and metals in pregnancy and the association with impaired glucose tolerance and gestational diabetes mellitus: The MIREC study. Environment International 83:63-71. |
| **HERO ID:** | 3005136 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling methodology only briefly described, cited previously published work (Arbuckle et al., 2014). |
| | Metric 2: | Analytical Methodology | Medium | Detailed analytical methodology, reported LOD. Some information missing such as calibration, may be mentioned in (Arbuckleet al., 2014; Langlois et al., 2014). |
| | Metric 3: | Biomarker Selection | High | Biomarker is known to be related with external exposure (MBzP). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Canada |
| | Metric 5: | Currency | Medium | 2008-2011 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 1274, no replicates (Table 2). |
| | Metric 7: | Exposure Scenario | High | Exposure to pregnant women. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Only geometric mean reported. |
| | Metric 9: | Quality Assurance | Low | QA/QC techniques were not discussed but can be implied through the study's techniques. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Characterized variability, discussed uncertainties and limitations. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Takeuchi, S., Tanaka-Kagawa, T., Saito, I., Kojima, H., Jin, K., Satoh, M., Kobayashi, S., Jinno, H. (2015). Differential determination of plasticizers and organophosphorus flame retardants in residential indoor air in Japan. Environmental Science and Pollution Research 25(8):7113-7120. |
| **HERO ID:** | 3005686 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | The indoor air and dust sampling methods were described but didn't include details about storage conditions. |
| | Metric 2: | Analytical Methodology | Medium | The analytical methods were described, including LOD. Limited details about recoveries were reported. |
| | Metric 3: | Biomarker Selection | N/A | The authors analyzed environmental samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The samples were collected in in Japan. |
| | Metric 5: | Currency | Medium | The sampling was performed during October 2013and January 2014. |
| | Metric 6: | Spatial and Temporal Variability | Low | n=19 for dust samples, 21 for indoor air samples. No replicates. |
| | Metric 7: | Exposure Scenario | Medium | The data likely represent relevant exposure scenarios related to indoor air and dust in Japanese dwellings, but the small sample size limits the results' generalizability. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics were reported, without individual sample concentrations. |
| | Metric 9: | Quality Assurance | High | QA/QC techniques were described, including the use of field and laboratory blanks. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability was not characterized. Uncertainties were briefly discussed. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Bi, C., Liang, Y., Xu, Y. (2015). Fate and transport of phthalates in indoor environments and the influence of temperature: A case study in a test house. Environmental Science & Technology 49(16):9674-9681. |
| **HERO ID:** | 3009291 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling equipment and methods for air, dust, and surface samples are described in excellent detail, including equipment preparation and sample storage conditions. The methods clear, complete, and scientifically sound. |
| | Metric 2: | Analytical Methodology | Low | Analytical instrumentation and methods are described in good detail, including sample extraction and instrument calibration. However, LOQ, LOD, or MDL are absent. |
| | Metric 3: | Biomarker Selection | N/A | This study is testing for the parent chemical of interest in environmental media (air, dust, and surfaces in a test house). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | This study took place in a test house located at the University of Texas at Austin in the United States. |
| | Metric 5: | Currency | Medium | While the specific timing of sample collection is not reported, the test house in which the study took place was built in 2008. The study was published in 2015. |
| | Metric 6: | Spatial and Temporal Variability | High | This study took place over four distinct monitoring periods lasting up to six months each where temperature was modulated in a single test house. Air samples were taken during each monitoring period with N ranging from 6 to 16, including duplicates. Sorbed phthalates were measured on different surfaces within the test house once per monitoring period. Dust samples were collected periodically but number of frequency of sampling was not specified. |
| | Metric 7: | Exposure Scenario | High | This experimental study measures phthalate concentrations in a "test house" that is designed to closely resemble real-life residential indoor environments, including building materials, contents, and typical temperature fluctuations. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Raw data were not reported. Figure 1 graphically depicts airborne concentrations at each timepoint, but the image resolution is too low to be meaningful beyond demonstrating trends. Summary statistics reported in the text include mean steady-state airborne concentrations for the first two monitoring periods (standard deviations are reported in supplementary material). Dust and sorbed surface concentrations are also graphically reported, with mean and standard deviation for dust concentrations of the first monitoring period only reported in text; sorbed surface concentrations are absent from the text. |
| | Metric 9: | Quality Assurance | High | QA/QC measures included the use of surrogate chemicals for determination of recoveries for each sample type, all of which were within acceptable ranges (85%-92%). During analysis, variance was reported to be below 10% for all gas chromatography injections. No QC issues were identified. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability is characterized over time and with changing temperature as the main topic of interest. Limitations are briefly discussed, including the assumption that indoor air is well mixed, but the majority of this discussion is focused on the fate and transport modeling and not pertinent to exposure monitoring data. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Saini, A., Okeme, J. O., Goosey, E., Diamond, M. L. (2015). Calibration of two passive air samplers for monitoring phthalates and brominated flame-retardants in indoor air. Chemosphere 137:166-173. |
| **HERO ID:** | 3009392 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Well described methodology |
| | Metric 2: | Analytical Methodology | High | Detailed methodology, included LOD and recoveries |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Canada |
| | Metric 5: | Currency | Medium | Sampling started in 2012 |
| | Metric 6: | Spatial and Temporal Variability | Medium | batches of 10 samples, limited details on use of replicates |
| | Metric 7: | Exposure Scenario | Medium | limited information on population of interest |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics |
| | Metric 9: | Quality Assurance | High | Well described QA/QC, reported recoveries, analyzed control samples QC: blank correction, surrogate standards. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited discussion of limitations and uncertainties QC: does discuss recommended sampling rates for different methods, and how that may affect variability |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Net, S., Rabodonirina, S., Sghaier, R. B., Dumoulin, D., Chbib, C., Tlili, I., Ouddane, B. (2015). Distribution of phthalates, pesticides and drug residues in the dissolved, particulate and sedimentary phases from transboundary rivers (France-Belgium). Science of the Total Environment 521-522:152-159. |
| **HERO ID:** | 3012380 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methodology (e.g., equipment, site/matrix characteristics) were described. |
| | Metric 2: | Analytical Methodology | Medium | A detailed analytical methodology was provided, but recoveries were missing. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in water and sediment. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected from France and Belgium. |
| | Metric 5: | Currency | Medium | Samples were collected in 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Sampled were collected from 15 sites without replicates. |
| | Metric 7: | Exposure Scenario | Medium | Paper has limited information on the population or microenvironment of interest. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Individual sample concentrations and summary statistics were reported in Table 3S. |
| | Metric 9: | Quality Assurance | Medium | There was limited information on field controls and recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | There was a very limited discussion of uncertainties and study limitations. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Ma, T. T., Wu, L., Chen, L., Zhang, H., Teng, Y., Luo, Y. M. (2015). Phthalate esters contamination in soils and vegetables of plastic film greenhouses of suburb Nanjing, China and the potential human health risk. Environmental Science and Pollution Research 22(16):12018-12028. |
| **HERO ID:** | 3016266 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported, including site characteristics/matrix, equipment, and storage. |
| | Metric 2: | Analytical Methodology | High | Analytical methods were performed according to a previously published paper that modified EPA method 8270C. |
| | Metric 3: | Biomarker Selection | N/A | Study tested for parent chemicals in soil and vegetables. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted in Nanjing, China. |
| | Metric 5: | Currency | Medium | Samples were collected in 2011. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Authors collected 305 samples from 61 greenhouses without replicates. |
| | Metric 7: | Exposure Scenario | Medium | The exposure source was not well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data and summary statistics only reported for one of the four suburbs studied (Table 4). Data for all suburbs are presented graphically in Fig 3 with some exact concentrations reported throughout the main text of Results. |
| | Metric 9: | Quality Assurance | Low | QA/QC can be inferred from the study's use of published literature and methods. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Key gaps and limitations not well characterized, and summary statistics were only partially reported. |

## Overall Quality Determination Medium

**Study Citation:** Bi, X., Yuan, S., Pan, X., Winstead, C., Wang, Q. (2015). Comparison, association, and risk assessment of phthalates in floor dust at different indoor environments in Delaware, USA. Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 50(14):1428-1439.

**HERO ID:** 3019857

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methods described sites, equipment, care to avoid cross-contamination, storage, and more. |
| | Metric 2: | Analytical Methodology | High | Analytical methodology described sample preparation, extraction, instrumentation, LODs, and more. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in indoor dust. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Dover, Delaware. |
| | Metric 5: | Currency | Medium | Data were collected in 2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | A total of 44 samples were collected without replicates. |
| | Metric 7: | Exposure Scenario | High | Exposure to dust from different indoor environments is relevant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data were provided but summary statistics were complete. |
| | Metric 9: | Quality Assurance | High | There was robust reporting of QA/QC, including triplicate analysis of each sample and acceptable recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Summary statistics were complete but gaps or limitations were only briefly reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Gao, C. J., Liu, L. Y., Ma, W. L., Ren, N. Q., Guo, Y., Zhu, N. Z., Jiang, L., Li, Y. F., Kannan, K. (2016). Phthalate metabolites in urine of Chinese young adults: Concentration, profile, exposure and cumulative risk assessment. Science of the Total Environment 543(Pt A):19-27. |
| **HERO ID:** | 3045442 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Most key criteria met. Duration of sample storage prior to analysis lacking for urine samples. Approaches to avoid contamination in sampling also missing. |
| | Metric 2: | Analytical Methodology | High | Key criteria met, LOQ's reported as range, recoveries reported. HPLC system electrospray triple quadrupole mass spectrometer (ESI–MS/MS). |
| | Metric 3: | Biomarker Selection | High | High. Sampling for metabolite specific for parent chemical. See Table S1 (supplemental). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. China. |
| | Metric 5: | Currency | Medium | Medium. Sampling conducted 2010. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Sampling in 108 participants across urban, rural areas covering most provinces and municipalities, males and females, first morning urine specimens. No replicates. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Participant characteristics summarized, potential exposure sources discussed, occupational status unknown, lack of baseline/control samples. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Most key criteria met. Lack of raw data. |
| | Metric 9: | Quality Assurance | Medium | Medium. Quality assurance key criteria met. Lack of baseline samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability represented by statistical summary measures, limitations discussed, uncertainties identified. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Shi, W., Deng, D., Wang, Y., Hu, G., Guo, J., Zhang, X., Wang, X., Giesy, J. P., Yu, H., Wang, Z. (2015). Causes of endocrine disrupting potencies in surface water in East China. Chemosphere 144:1435-1442. |
| **HERO ID:** | 3045459 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Scientifically sound, well described methodology that includes site characteristics, sampling equipment, and storage conditions. |
| | Metric 2: | Analytical Methodology | Medium | LOQs and recoveries were reported, but limited information on instrument calibration. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study conducted in China. |
| | Metric 5: | Currency | Medium | Samples were collected in 2011. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Samples were collected from 12 locations of 20L each without replicates. |
| | Metric 7: | Exposure Scenario | Medium | There was limited information on the population and microenvironment of interest. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual sample concentrations were reported but most summary statistics were missing. |
| | Metric 9: | Quality Assurance | Medium | There was limited reporting of QA/QC techniques. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | There was no characterization of variance (although raw data were provided) and discussion of uncertainties and limitations. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Zhang, Y., Liang, Q., Gao, R., Hou, H., Tan, W., He, X., Zhang, H., Yu, M., Ma, L., Xi, B., Wang, X. (2015). Contamination of Phthalate Esters (PAEs) in Typical Wastewater-Irrigated Agricultural Soils in Hebei, North China. PLoS ONE 10(9):e0137998. |
| **HERO ID:** | 3045478 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Soil samples irrigated with river water were collected from 13 sites along the river (Fig 1); topsoil (0-20cm), river water, and sediment (0-5cm) were also collected. Sampling methods and storage were clearly outlined. |
| | Metric 2: | Analytical Methodology | Medium | Recoveries and LOD ranges for water, sediment, and soil were provided on p. 4. Analytical methods were outlined, but it is difficult to determine whether these methods and the sample pretreatment follows an accepted standard. |
| | Metric 3: | Biomarker Selection | N/A | Samples were from environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Wangyang River (WYR) in Shijiazhuang City, Hebei Province, North China |
| | Metric 5: | Currency | Medium | 2013 |
| | Metric 6: | Spatial and Temporal Variability | High | The paper reports 39 samples were collected from 13 sites. It also states that there were 3 water samples and 4 sediment samples collected from each site. Soil samples were collected from each site in triplicate. |
| | Metric 7: | Exposure Scenario | Medium | River surface water, sediment, and soil came from areas irrigated with wastewater. Industrial effluents from petrochemical, electronic, and pharmaceutical factories are discharged into the river after these effluents are subjected to secondary (biological) treatment; the river water has been used to irrigate farmland soil for 20 years. Data likely represent the exposure scenario in that region, at least in early summer. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 1 provides the range, mean, SD, detection frequency, and median levels detected in surface water, sediment, and soil. Raw data are not provided. |
| | Metric 9: | Quality Assurance | High | Recovery was 98.7%; blanks were used. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Results were compared to those of several previous studies (Table 2). The paper addressed variation between soil and sediment samples and the spatial distribution of results. However, there was no discussion of uncertainty or study limitations. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Axelsson, J., Rylander, L., Rignell-Hydbom, A., Jönsson, B. A., Lindh, C. H., Giwercman, A. (2015). Phthalate exposure and reproductive parameters in young men from the general Swedish population. Environment International 85:54-60. |
| **HERO ID:** | 3045487 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | The sampling methodology of biological fluids was described but did not include storage conditions. |
| | Metric 2: | Analytical Methodology | Medium | The analytical methods were described in detail, including LOD and instrumentation, but the authors did not report recoveries. |
| | Metric 3: | Biomarker Selection | High | The analyzed metabolites are closely related to exposure to the parent chemicals of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in Sweden. |
| | Metric 5: | Currency | Medium | The samples were collected between 2008 and 2010. |
| | Metric 6: | Spatial and Temporal Variability | Medium | n=314 study participants, no replicates |
| | Metric 7: | Exposure Scenario | High | The data closely represent a relevant exposure scenario related to exposure to phthalates for men in the general population. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | The authors reported summary statistics only (range, median, mean, SD). Raw data not reported. |
| | Metric 9: | Quality Assurance | Medium | The authors mention the use of control samples and report concentrations in the Supplementary Material but details about QA/QC techniques are scarce. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability was characterized (range, SD). Uncertainties and limitations were described. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Den Hond, E., Tournaye, H., De Sutter, P., Ombelet, W., Baeyens, W., Covaci, A., Cox, B., Nawrot, T. S., Van Larebeke, N., D'Hooghe, T. (2015). Human exposure to endocrine disrupting chemicals and fertility: A case-control study in male subfertility patients. Environment International 84:154-160. |
| **HERO ID:** | 3045496 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Most key criteria met. Duration of sample storage prior to analysis lacking. |
| | Metric 2: | Analytical Methodology | Low | Low. Details described in Angerer (2008). LOQ's not reported. |
| | Metric 3: | Biomarker Selection | High | High. Sampling for metabolites specific for parent chemicals (MnBP, MBzP). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Belgium. |
| | Metric 5: | Currency | Low | Low. No sampling dates, publication date 2015. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Medium. Single spot urine samples from each of 163 men, non-statistical sampling method. No replicates. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Participant characteristics reported, lack of baseline/control samples. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Exposure levels and mean reported, lack of detection frequency and raw data. |
| | Metric 9: | Quality Assurance | Low | Some quality assurance procedures in sampling equipment and standard procedures. Lack of recovery data and blanks. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability summarized within statistical summary measures, study limitations discussed. |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | Starling, A. P., Engel, L. S., Calafat, A. M., Koutros, S., Satagopan, J. M., Yang, G., Matthews, C. E., Cai, Q., Buckley, J. P., Ji, B. T., Cai, H., Chow, W. H., Zheng, W., Gao, Y. T., Rothman, N., Xiang, Y. B., Shu, X. O. (2015). Predictors and long-term reproducibility of urinary phthalate metabolites in middle-aged men and women living in urban Shanghai. Environment International 84:94-106. |
| **HERO ID:** | 3045503 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Enrollment described, timing of samples, containers and storage described. |
| | Metric 2: | Analytical Methodology | Low | CDC lab performed analyses; previously published laboratorymethods (Kato et al., 2005; Silva et al., 2008), LOD provided. |
| | Metric 3: | Biomarker Selection | High | Metabolite in urine. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China. |
| | Metric 5: | Currency | Low | Women samples from 1997-2000 and men from 2006-2007. |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 50 men and 50 women, no replicates. |
| | Metric 7: | Exposure Scenario | High | Biomonitoring. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | GM, 5th, 95th, % below LOD. |
| | Metric 9: | Quality Assurance | Medium | Ten blinded, pooled quality control samples were also included along with the subject samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability discussed, uncertainty included in percentiles. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Mu, D., Gao, F., Fan, Z., Shen, H., Peng, H., Hu, J. (2015). Levels of phthalate metabolites in urine of pregnant women and risk of clinical pregnancy loss. Environmental Science & Technology 49(17):10651-10657. |
| **HERO ID:** | 3045505 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Control group and woman who underwent clinical pregnancy loss from Beijing, China. One sample per woman, sample storage and analysis characteristics well described. |
| | Metric 2: | Analytical Methodology | High | Extraction methods, analytical equipment, calibration, blanks, spiked samples, LOD, LOQ all described. |
| | Metric 3: | Biomarker Selection | High | Metabolite known to be derived from parent chemical (MnBP). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Beijing, China |
| | Metric 5: | Currency | Medium | September 2011 to June 2014 |
| | Metric 6: | Spatial and Temporal Variability | Medium | One sample per woman, individually analyzed, 304 samples in total. No replicates. Morning urine samples. |
| | Metric 7: | Exposure Scenario | High | Exposure to pregnant women. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data reported. Percent of samples > LOD, median, P5, P95 and Concentration Ranges within the 1st, 2nd, 3rd and 4th Quartiles reported for MEP, MiBP, and MnBP. |
| | Metric 9: | Quality Assurance | High | Blanks, spiked samples at 2 levels. The recoveries for all target chemicals ranged from 75.7 to 90.1%, and limits of detection (LODs) and limits of quantitation (LOQs) were 0.1−0.27 and 0.3−0.7 $\mu$g/L, respectively. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study mentions limitations such as a single urine sample was measured in this study, which would lead to considerable day-to-day variation. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | You, L., Wang, Y., Zeng, Q., Li, M.,in, Huang, Y., Hu, Y.,u, Cao, W., Liu, A., Lu, W. (2015). Semen phthalate metabolites, spermatozoa apoptosis, and dna damage: a cross-sectional study in China. Environmental Science & Technology 49(6):3805-3812. |
| **HERO ID:** | 3045587 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | High. Key criteria met, samples analyzed within one hour of collection. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Most key criteria met, LOD's reported. Lack of recovery data. |
| | Metric 3: | Biomarker Selection | Low | Low. Metabolites not specific for parent chemicals. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. China. |
| | Metric 5: | Currency | Medium | Medium. Samples collected 2012-2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Medium. Single semen sample per participant, n=463 participants, non-statistical sampling methods. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Participant characteristics summarized, lack of baseline/control exposure samples, occupational data within questionnaire not detailed. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Most key criteria met, detection frequency reported, lack of raw data. |
| | Metric 9: | Quality Assurance | Medium | Medium. Quality assurance procedures in sample collection and analysis reported with most key criteria met. False discoveryrate (FDR) was used. No recovery reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Medium. Variability summarized within statistical summary measures, discussion of potential study limitations. |
| **Overall Quality Determination** | | | **Medium** | |

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|---|---|
| **Study Citation:** | Dewalque, L., Pirard, C., Vandepaer, S., Charlier, C. (2015). Temporal variability of urinary concentrations of phthalate metabolites, parabens and benzophenone-3 in a Belgian adult population. Environmental Research 142:414-423. |
| **HERO ID:** | 3045602 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Urine samples collection and population described. Participants from previous study (Dewalqueetal.,2014a); limited details about urine sampling were enough to deem it reliable. |
| | Metric 2: | Analytical Methodology | Low | The analytical procedure, consisting an enzymatic hydrolysis and a solid phase extraction followed by liquid chromatography tandem mass spectrometry, has been previously described (Dewalqueetal., 2014c). Missing QA/QC details and LODs |
| | Metric 3: | Biomarker Selection | High | metabolite in urine |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Belgium |
| | Metric 5: | Currency | Medium | 2013 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 32 adults, 351 samples, no replicates |
| | Metric 7: | Exposure Scenario | High | biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table S2: GM, 95%CI, 50th, 95th min, max |
| | Metric 9: | Quality Assurance | Low | QA not discussed, no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Wang, L., Xu, X.,ue, Lu, X. (2015). Phthalic acid esters (PAEs) in vegetable soil from the suburbs of Xianyang city, Northwest China. Environmental Earth Sciences 74(2):1487-1496. |
| **HERO ID:** | 3045628 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported (e.g., site characteristics, equipment, storage condition). |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported. LOD reported in QC/QA section of main text. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in soil. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was performed in Xianyang city, Northwest China. |
| | Metric 5: | Currency | Medium | Samples were collected in 2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Nearly 60 samples were collected from four vegetable production fields without replicates. |
| | Metric 7: | Exposure Scenario | Medium | Exposure of urban population to phthalates in vegetable soil from modern agricultural practices and deposition was characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not provided. |
| | Metric 9: | Quality Assurance | High | QA/QC techniques reported, including blank samples, recovery (acceptable), and prevention of cross contamination. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | There is no robust characterization of variance and gaps or limitations. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | HEW, (2016). Current status and historical variations of phthalate ester (PAE) contamination in the sediments from a large Chinese lake (Lake Chaohu). Environmental Science and Pollution Research 23(11):10393-10405. |
| **HERO ID:** | 3052884 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported (e.g., site characteristics, location, equipment). |
| | Metric 2: | Analytical Methodology | Medium | Key analytical methods reported, but LOD were only reported as a range for all but two of the PAEs combined. Paper did note that the supplemental materials provide detailed recoveries and detection limits. However, supplemental materials were not available at the time of QC. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent compounds in media (sediment). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Lake Chaohu, China. |
| | Metric 5: | Currency | Medium | Samples were collected in 2011. |
| | Metric 6: | Spatial and Temporal Variability | Medium | More than 20 samples were collected without replicates. |
| | Metric 7: | Exposure Scenario | High | Authors measured phthalate concentrations in a lake that serves as an important source of drinking water, industry, and agriculture for millions of residents. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not provided. |
| | Metric 9: | Quality Assurance | High | Key QA/QC reported. Recoveries for all but one non-TSCA phthalate were acceptable. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Key gaps and limitations were not reported. Standard deviations provided in Table 1 for surface sediment, and ranges provided in Table 5 for core sediment. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Myridakis, A., Chalkiadaki, G., Fotou, M., Kogevinas, M., Chatzi, L., Stephanou, E. G. (2016). Exposure of preschool-age Greek children (RHEA Cohort) to bisphenol A, parabens, phthalates, and organophosphates. Environmental Science & Technology 50(2):932-941. |
| **HERO ID:** | 3070749 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Most key criteria met. Lack of duration of sample storage data. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Most key criteria met, mLOD's reported in Table 1, lack of recovery data. |
| | Metric 3: | Biomarker Selection | Low | Low. Sampling for metabolites not specific for parent chemical of interest |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Samples provided by participants in Heraklion, Crete, Greece. |
| | Metric 5: | Currency | Medium | Medium. Sampling dates for children not provided, but inferred from text as approximately 2008-2012, publication date 2015. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Medium. Spot urine samples obtained from children at 4 years of age, total of n=500 samples collected from 500 children randomly selected from n=800 volunteers. |
| | Metric 7: | Exposure Scenario | High | High. Potential exposure sources explored within principal component analysis, participant characteristics described. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Most key criteria met; lack of raw data. |
| | Metric 9: | Quality Assurance | Medium | Medium. Quality assurance procedures described, most key criteria met; lack of recovery data. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Medium. Variability characterized within summary statistics, robust discussion of potential reasons for mixed results in comparisons with previous studies. |
| **Overall Quality Determination** | | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | Wang, Y. X., Zeng, Q., Sun, Y., Yang, P., Wang, P., Li, J., Huang, Z., You, L., Huang, Y. H., Wang, C., Li, Y. F., Lu, W. Q. (2016). Semen phthalate metabolites, semen quality parameters and serum reproductive hormones: A cross-sectional study in China. Environmental Pollution 211:173-182. |
| **HERO ID:** | 3070898 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | population previously described (Wang et al., 2015; You et al., 2015); sample collection minimal description, missing contamination avoidance approaches. |
| | Metric 2: | Analytical Methodology | Medium | Method previously described (You et al., 2015) and briefly summarized here; LOD range provided. Some analytical QA/QC processes were reported. Analyzed using high-performance liquid chromatograph and finally detected using a triple quad mass spectrometer. |
| | Metric 3: | Biomarker Selection | High | metabolite in semen |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | 2013 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 687, no replicates |
| | Metric 7: | Exposure Scenario | High | biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | mean, median, 10th, 25th, 75th, 90th |
| | Metric 9: | Quality Assurance | Medium | blanks and spiked QC samples described |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Gomez Ramos, M. J., Heffernan, A. L., Toms, L. M., Calafat, A. M., Ye, X., Hobson, P., Broomhall, S., Mueller, J. F. (2016). Concentrations of phthalates and DINCH metabolites in pooled urine from Queensland, Australia. Environment International 88(Elsevier):179-186. |
| **HERO ID:** | 3070900 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Surplus stored urine samples, pooled, could have been collected any time of day. |
| | Metric 2: | Analytical Methodology | Medium | Analyses performed by CDC, LOD provided. Analysis was done using solid phase extraction-high performance liquid chromatography isotope dilution tandem mass spectrometry as described previously (Silva et al., 2007a). QA/QC was performed but not reported. |
| | Metric 3: | Biomarker Selection | High | Metabolite in urine. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Australia. |
| | Metric 5: | Currency | Medium | 2012-2013. |
| | Metric 6: | Spatial and Temporal Variability | Low | 24 pooled samples of 100 urine samples; urine collection varied. |
| | Metric 7: | Exposure Scenario | High | Biomonitoring. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data from pooled samples in Table 2. |
| | Metric 9: | Quality Assurance | Low | QC not discussed, no obvious concerns. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability captured from 24 different pools; uncertainty not discussed, no obvious concerns. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Sun, J., Pan, L., Zhan, Y., Lu, H., Tsang, D. C., Liu, W., Wang, X., Li, X., Zhu, L. (2015). Contamination of phthalate esters, organochlorine pesticides and polybrominated diphenyl ethers in agricultural soils from the Yangtze River Delta of China. Science of the Total Environment 544:670-676. |
| **HERO ID:** | 3070929 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods (e.g., site characteristics, sampling location, equipment) were reported. |
| | Metric 2: | Analytical Methodology | Medium | Key analytical methods (e.g., instrumentation, extraction) were reported. However, LODs were only reported as a range for all phthalates combined. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in the soil. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was performed in the Yangtze River Delta, China. |
| | Metric 5: | Currency | Medium | Samples were collected in 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | A total of 241 topsoil samples were collected without replicates. |
| | Metric 7: | Exposure Scenario | High | Authors measured the levels of phthalates in farmland soil resulting from rapid urbanization. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. |
| | Metric 9: | Quality Assurance | High | Key QA/QC were reported, such as duplicate analysis, recoveries, and blank corrections. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Gaps and limitations were not reported, and variance only characterized by min and max. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | SUNY, (2015). Phthalate exposure in association with serum hormone levels, sperm DNA damage and spermatozoa apoptosis: A cross-sectional study in China. Environmental Research 150:557-565. |
| **HERO ID:** | 3070933 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Spot urine shipping, presumably collected and prepared by participants, were described. Storage conditions were also included. Enrollment was only briefly covered, but authors did cite a previously published paper for more details. |
| | Metric 2: | Analytical Methodology | Low | Analytical methods were briefly reported and a previous paper (Wang et al.,2015) was cited for more details. Authors also described equipment and instrumentation, However, LOD was only reported as a range for all metabolites combined. |
| | Metric 3: | Biomarker Selection | High | MzBP is specific to BzBP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted in China. |
| | Metric 5: | Currency | Medium | Samples were collected in 2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Over 1000 participants provided blood and urine samples without replicates. (Two urine samples were collected to capture almost 24 hour variability, which isn't equivalent to replicates). |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data were provided. |
| | Metric 9: | Quality Assurance | Low | Other than a single sentence about preparing control samples, QA/QC techniques were not discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Uncertainty, limitations, and gaps were not discussed. Table S2 provided interquartile range of metabolites in two spot-urine samples. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Asimakopoulos, A. G., Xue, J., De Carvalho, B. P., Iyer, A., Abualnaja, K. O., Yaghmoor, S. S., Kumosani, T. A., Kannan, K. (2016). Urinary biomarkers of exposure to 57 xenobiotics and its association with oxidative stress in a population in Jeddah, Saudi Arabia. Environmental Research 150:573–581. |
| **HERO ID:** | 3070934 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Participants and sample collection described, storage described. Missing information such as container used for collection. |
| | Metric 2: | Analytical Methodology | High | LOD, LOQ, extraction, calibration, recoveries, equipment and detailed methods in SI. |
| | Metric 3: | Biomarker Selection | High | Metabolites known to be derived from parent compound (MBzP). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Saudi Arabia |
| | Metric 5: | Currency | Medium | 2014 |
| | Metric 6: | Spatial and Temporal Variability | Low | n =130, no replicates. Spot urine samples. |
| | Metric 7: | Exposure Scenario | Medium | Exposure to general population who visited a hospital. No information given on how subjects were chosen. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Min, max, mean, median for detects only; Kaplan-Meier method including non-detects. Individual points not reported. |
| | Metric 9: | Quality Assurance | High | High recoveries (over 70%), matrix effects, LODs, calibration, blanks, internal and external standards described. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Some discussion of variability, comparison with other studies. Discussion of limitations. |
| **Overall Quality Determination** | | | **High** | |

| | |
|---|---|
| **Study Citation:** | Wang, X., Song, M., Guo, M., Chi, C., Mo, F., Shen, X. (2015). Pollution levels and characteristics of phthalate esters in indoor air in hospitals. Journal of Environmental Sciences 37:67-74. |
| **HERO ID:** | 3070971 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling procedure, equipment, and matrix characteristics were reported. |
| | Metric 2: | Analytical Methodology | High | HPLC with GC was used for analysis; method detection limits were reported for each chemical at the end of QA/QC section. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in indoor air. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected from five hospitals in China. |
| | Metric 5: | Currency | Medium | Samples were collected in 2012 and 2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Five hospitals and six different rooms were sampled within each hospital. Authors reported that "this study used repeated sampling." However, there was no further elaboration on what that meant to assess if replicates were collected. |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant exposure scenario (indoor air/dust in hospitals). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Mean concentrations with range were reported; no individual data were reported. |
| | Metric 9: | Quality Assurance | High | QA/QC were performed and recovery rate was between 91.75% and 115.1%. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variance was characterized by range. Discussion of limitations, gaps, or uncertainties was mostly absent. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Chau, H. T., Kadokami, K., Duong, H. T., Kong, L., Nguyen, T. T., Nguyen, T. Q., Ito, Y. (2015). Occurrence of 1153 organic micropollutants in the aquatic environment of Vietnam. Environmental Science and Pollution Research 25(8):7147-7156. |
| **HERO ID:** | 3071076 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | The authors report a sampling procedure and the sampling equipment. They report the storage conditions but not the storage duration. |
| | Metric 2: | Analytical Methodology | Low | The authors report the analytical methods and equipment used in the study. They also performed recovery studies, and calibration studies. Authors only reported a range for the LODs for all 100+ chemicals combined. While Table 2 does list LODs for commonly detected chemicals, only TPP and DnBP are included; no LODs are available for BBP and DEHP. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in surface water. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Vietnam |
| | Metric 5: | Currency | Medium | The samples were collected in 2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | The authors collected 42 samples from different rivers, cities, canals, and urban/rural areas in Vietnam. Per river, the number of samples ranged from 1 to 14. Authors collected one sample in time (no repeat sampling). |
| | Metric 7: | Exposure Scenario | Medium | Exposure to organic contaminants in surface water throughout the country in urban, suburban, and rural areas |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | The authors report the sample size, frequency of detection, median and maximum, but not measures of variation. The authors report the individual sample concentration in the supplemental material. |
| | Metric 9: | Quality Assurance | Low | The authors reported analyzing lab blanks, and performing recovery studies. They did not collect field blanks. Recovery ranges were reported to be between 50-120% but the authors did not say if they adjusted based on low recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | The authors did not report a standard deviation and did not discuss in detail gaps, limits, or variability within their study. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Ros, O., Izaguirre, J. K., Olivares, M., Bizarro, C., Ortiz-Zarragoitia, M., Cajaraville, M. P., Etxebarria, N., Prieto, A., Vallejo, A. (2015). Determination of endocrine disrupting compounds and their metabolites in fish bile. Science of the Total Environment 536:261-267. |
| **HERO ID:** | 3071092 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sample collection is described in Section 2.2.1. |
| | Metric 2: | Analytical Methodology | High | The samples were analyzed by gas-chromatography–mass spectrometry (GC–MS), though the polar fraction required a previous derivatization with O-bis (trimethylsilyl) trifluoroacetamide. LOD discussed. |
| | Metric 3: | Biomarker Selection | Medium | These values indicate that fish bile is suitable for biomonitoringpurposes. Finally, the results might indicate a relationship between the analyte concentration in water samples with the number of intersex fish, as the case of Gernika, but no clear relation has been observed between the intersex condition and the analytes in the fish bile. Deeper studies have to be performed in this sense to get a firmly conclusion. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Basque coast. |
| | Metric 5: | Currency | Medium | May–June 2012 |
| | Metric 6: | Spatial and Temporal Variability | Medium | While there were 12-30 samples, there were no replicates reported. |
| | Metric 7: | Exposure Scenario | High | The exposure scenario assessed may be useful in a TSCA aquatic exposure assessment or potential fish ingestion exposures. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Results are sufficiently reposted and described. |
| | Metric 9: | Quality Assurance | High | The study reported recovery and reproducibility. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Some discussion of variability is provided (section 3.3, table 1). |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Mo, C., Cai, Q. Y., Tang, S., Zeng, Q., Wu, Q.,iT (2009). Polycyclic Aromatic Hydrocarbons and Phthalic Acid Esters in Vegetables from Nine Farms of the Pearl River Delta, South China. Archives of Environmental Contamination and Toxicology 56(2):181-189. |
| **HERO ID:** | 3112241 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Location map in SI; sample prep described, locations and number of samples in Table 1. Approach to avoid contamination provided. |
| | Metric 2: | Analytical Methodology | Medium | EPA methods for extraction and cleanup; equipment and methods provided. Detected by gas chromatography coupled with mass spectrometry (GC/MS). Calibration, blanks, internal standards, recoveries, QA/QC described and reliable, but not reported. |
| | Metric 3: | Biomarker Selection | N/A | NA - vegetable samples no biomarker needed. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Low | Sample collection and analysis not provided, publication date 2009. |
| | Metric 6: | Spatial and Temporal Variability | Medium | sample size 2 to 11 for 11 plant species, see Table 1 |
| | Metric 7: | Exposure Scenario | High | Vegetables from farms, could be used for homegrown vegetable scenarios. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary tables in main paper min, max, mean is reported in Table 3 and supplement information |
| | Metric 9: | Quality Assurance | Medium | Calibration, blanks, internal standards, recoveries, QA/QC described and reliable, but not reported. Details of quality assurance/quality control (QA/QC) have been presented elsewhere (Cai et al. 2007a) |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability among vegetables discussed. The occurrences of PAHs and PAEs in this study are compared with those in other studies and their sources are discussed. Sources of the uncertainty, within the samples was not attributed to soil variability or other dynamics within biological samples. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Choi, H., Schmidbauer, N., Bornehag, C. G. (2016). Non-microbial sources of microbial volatile organic compounds. Environmental Research 148:127-136. |
| **HERO ID:** | 3207434 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Describes sampling methodology, cites previous manuscripts with more details. Does not include approaches to avoid phthalate contamination while sampling. |
| | Metric 2: | Analytical Methodology | Low | Does not report LOD,LOQ or recoveries, or analytical methods. |
| | Metric 3: | Biomarker Selection | N/A | NA - dust samples |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sweden |
| | Metric 5: | Currency | Low | Sampling began in 2001 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 390 sampling sites, no replicates |
| | Metric 7: | Exposure Scenario | High | Data closely represents a relevant exposure scenario |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics |
| | Metric 9: | Quality Assurance | Low | Limited details on QA/QC |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Limited discussion of study limitations and uncertainties |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Gong, M., Weschler, C. J., Zhang, Y. (2016). Impact of clothing on dermal exposure to phthalates: Observations and insights from sampling both skin and clothing. Environmental Science & Technology 50(8):4350-4357. |
| **HERO ID:** | 3229677 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Wipe procedure described and diagramed |
| | Metric 2: | Analytical Methodology | Low | ”analyzed using methods similar to those described in previous study (41)” no other details; no LOD |
| | Metric 3: | Biomarker Selection | N/A | parent in dermal wipe |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | November 2014 for winter samples (this study) and June-July 2013 for the summer study samples (reported in Gong, M. Y.; Weschler, C. J.; Liu, L. P.; Shen, H. Q.; Huang, L. H.; Sundell, J.; Zhang, Y. P. Phthalate metabolites in urine samples from Beijing children and correlations with phthalate levels in their handwipes. Indoor Air 2015, 25 (6), 572−581. |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 11, no replicates |
| | Metric 7: | Exposure Scenario | High | Dermal exposure from clothing. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | mean, range, 50th, 75th |
| | Metric 9: | Quality Assurance | Low | QA not discussed, no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | uncertainty not discussed; variability discussed with respect to clothing versus skin and time of year |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | Raffy, G., Mercier, F., Blanchard, O., Derbez, M., Dassonville, C., Bonvallot, N., Glorennec, P., Le Bot, B. (2016). Semi-volatile organic compounds in the air and dust of 30 French schools: A pilot study. Indoor Air 27(1):114-127. |
| **HERO ID:** | 3229681 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Air sampling described; methods for dust sampling described in SI and in Blanchard et al. (2014). |
| | Metric 2: | Analytical Methodology | High | Details provided in SI, Mercier et al. (2014), and Blanchard et al. (2014). PLE and GC/MS; 5-level calibration; LOQs; field and lab blanks, and QA samples and recoveries. |
| | Metric 3: | Biomarker Selection | N/A | Air and dust sampling |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Brittany, France |
| | Metric 5: | Currency | Medium | 2009 to 2010 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 33 schools, 3 rooms per school, Air: single 4.5-day continuous sample/room, 1 field blank/school; Dust 1 vacuum per room and 3 damp wipes per room. |
| | Metric 7: | Exposure Scenario | High | School classrooms: air and dust samples. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | 5th, 50th, and 95th percentiles (no mean, no variance); N, freq. of detect, LOQ and upper limit of calibration reported. |
| | Metric 9: | Quality Assurance | High | Well described in text and SI and includes recovery calculation, running blanks and QC samples |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Discussed analytic issues, uncertainties, possible confounding factors, and excluded data. Variation within and across schools not discussed. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Braouezec, C., Enriquez, B., Blanchard, M., Chevreuil, M., Teil, M. J. (2016). Cat serum contamination by phthalates, PCBs, and PBDEs versus food and indoor air. Environmental Science and Pollution Research 23(10):9574-9584. |
| **HERO ID:** | 3229683 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Air, cat blood serum, cat food. Missing air sampling time intervals, seems the air sample was for 3 periods of 2 weeks each. Unclear if they sample cat serum every 12 hours for the same period they collected air samples. Approaches to avoid contamination not included. Description of sampling space provided but missing key details. Controlled environment was set up to mimic indoor, not completely described to fully assess/characterize sources of the chemicals, such as building materials, consumer products present, and others. This scenario is mainly to assess cat related products and food as sources. |
| | Metric 2: | Analytical Methodology | High | Extraction, fractionation, purification, analyses, methods quality controls, detection limit range |
| | Metric 3: | Biomarker Selection | N/A | Measured parent chemical in blood serum. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | France |
| | Metric 5: | Currency | Low | Sampling date not provided, published 2016. |
| | Metric 6: | Spatial and Temporal Variability | Low | 8 cats; indoor air (missing collection and food sample size not shown). |
| | Metric 7: | Exposure Scenario | Medium | Indoor air at University Pierre et Marie Curie. Scenario may be used for cat products emissions and cat food background levels. However, is missing a better description of materials present in the control indoor environment. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 1 individual data points available for serum for 8 cats; Figure 1 food and air graphs. |
| | Metric 9: | Quality Assurance | High | Lab blanks, IDL, LOQ, recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability and uncertainty not discussed, no obvious concerns. Sources of uncertainty and variability from cross contamination, and materials within the indoor environment missing. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Shoaff, J. R., Romano, M. E., Yolton, K., Lanphear, B. P., Calafat, A. M., Braun, J. M. (2016). Prenatal phthalate exposure and infant size at birth and gestational duration. Environmental Research 150(Elsevier):52-58. |
| **HERO ID:** | 3230353 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology included information of participant characteristics, equipment, storage, and more. |
| | Metric 2: | Analytical Methodology | Low | Authors cited previously published analytical methods without any further details. LODs provided as a range for all metabolites combined. |
| | Metric 3: | Biomarker Selection | High | MBzP is specific to BBzP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study participants were from Cincinnati, Ohio. |
| | Metric 5: | Currency | Medium | Participant recruitment occurred between 2003 and 2006. |
| | Metric 6: | Spatial and Temporal Variability | Low | Sample size consisted of 368 infant pairs. Two spot samples were collected at different points in gestation. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study where mothers were exposed through the prevalence of phthalates and children in-utero. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data were provided. |
| | Metric 9: | Quality Assurance | Low | QA/QC techniques were not described. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variance was characterized but discussion of uncertainties and limitations was mostly absent. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Ortiz-Colón, A. I., Piñero-Santiago, L. E., Rivera, N. M., Sosa, M. A. (2016). Assessment of concentrations of heavy metals and phthalates in two urban rivers of the northeast of Puerto Rico. Journal of Environmental & Analytical Toxicology 6(2):1000353. |
| **HERO ID:** | 3230372 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The water sampling methodology was described and cited EPA methods 200.8 and 200.2. |
| | Metric 2: | Analytical Methodology | Medium | The analytical methods were described, including a general LOD but did not include recoveries. |
| | Metric 3: | Biomarker Selection | N/A | The authors analyzed water samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in Puerto Rico. |
| | Metric 5: | Currency | Medium | The sampling campaign was conducted in 2013. |
| | Metric 6: | Spatial and Temporal Variability | Low | n=8 sites with triplicate samples |
| | Metric 7: | Exposure Scenario | Medium | The data may represent a relevant exposure scenario, but the small sample size limits the results generalizability. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Only three data points were reported in the text for DBP, data for other phthalates were not reported due to instrument unreliability per the authors description. |
| | Metric 9: | Quality Assurance | Medium | QA/QC techniques were briefly described, including the use of control samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability was not characterized. Uncertainties and limitations were briefly discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Zhang, J., Liu, L., Wang, X., Huang, Q., Tian, M., Shen, H. (2016). Low-level environmental phthalate exposure associates with urine metabolome alteration in a Chinese male cohort. Environmental Science & Technology 50(11):5953-5960. |
| **HERO ID:** | 3230375 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some sampling methods were not reported, such as storage duration. |
| | Metric 2: | Analytical Methodology | Medium | Recovery samples were not reported. LODs reported in text under Urinary Phthalate Metabolite Analysis. |
| | Metric 3: | Biomarker Selection | High | MBzP is specific to BBzP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in China. |
| | Metric 5: | Currency | Low | Sample date was not provided. Study was published in 2016. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Spot morning urine samples were collected from 364 mean without replicates. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study where exposure presumably already occurred. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. |
| | Metric 9: | Quality Assurance | High | QA/QC reported in the supplemental materials. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | There was only a limited characterization of variance. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Jurewicz, J., Radwan, M., Sobala, W., Radwan, P., Jakubowski, L., Wielgomas, B., Ligocka, D., Brzeźnicki, S., Hanke, W. (2016). Exposure to widespread environmental endocrine disrupting chemicals and human sperm sex ratio. Environmental Pollution 213:732-740. |
| **HERO ID:** | 3230399 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Urine, saliva, and semen samples. Most key criteria met, lack of duration of urine sample storage prior to analysis information. Most details are available in Jurewicz et al., 2014, parent study. This study is a subset of the parent study. This study was specifically for Phthalates. May use the parent study descriptions, but the results needed are in this reference. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Most key criteria met, LOD's reported. Lack of recovery sample data. |
| | Metric 3: | Biomarker Selection | Medium | Metabolites measured are for BBP, DBP, DEHP, DINP, although some may apply to other phthalates too |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Samples collected from participants in Poland. |
| | Metric 5: | Currency | Medium | Medium. Samples collected 2008-2011. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Medium. Single urine specimen on one day provided by each of n=194 men, collection of samples 2008-2011, non-statistical sampling method. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Participant characteristics described, potential exposure sources, occupational history not detailed. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Most key criteria met, text notes metabolites detected in 100% of samples, lack of raw data. |
| | Metric 9: | Quality Assurance | Medium | Medium. Most key criteria met, lack of detail on control/blank samples, however laboratory participated in external quality assurance program. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | High. Variability summarized within statistical summary measures, limitations discussed, uncertainties minimal. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Huen, K., Calafat, A. M., Bradman, A., Yousefi, P., Eskenazi, B., Holland, N. (2016). Maternal phthalate exposure during pregnancy is associated with DNA methylation of LINE-1 and Alu repetitive elements in Mexican-American children. Environmental Research 148:55-62. |
| **HERO ID:** | 3230402 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Two urine samples were collected from mothers at the time ofinterview, aliquoted, barcoded and stored at -80 °C. |
| | Metric 2: | Analytical Methodology | High | Measurements were performed using solid phase extraction coupled with isotope dilution high-performance liquid chromatography-electro spray ionization-tandem mass spectrometry. The LODs are reported in table 2. |
| | Metric 3: | Biomarker Selection | High | MBzP is a metabolite of butyl benzyl phthalate (BBzP). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Salinas, California. |
| | Metric 5: | Currency | Medium | 1999-2000. |
| | Metric 6: | Spatial and Temporal Variability | High | 350 mothers at 13 weeks of pregnancy and 339 at 26 weeks of pregnancy. |
| | Metric 7: | Exposure Scenario | High | Maternal phthalate exposure in a Mexican American community in Salinas California. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No individual sample concentrations. Table 2 reports data as median (IQR) min and max. |
| | Metric 9: | Quality Assurance | High | Quality control procedures included the use of laboratory and field blanks, calibration standards, and controls with high and low concentrations. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Key limitations are reported. |

## Overall Quality Determination High

**Study Citation:** Arbuckle, T. E., Fisher, M., Macpherson, S., Lang, C., Provencher, G., Leblanc, A., Hauser, R., Feeley, M., Ayotte, P., Neisa, A., Ramsay, T., Tawagi, G. (2016). Maternal and early life exposure to phthalates: The Plastics and Personal-care Products use in Pregnancy (P4) study. Science of the Total Environment 551-552(Elsevier):344-356.

**HERO ID:** 3230415

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported. |
| | Metric 3: | Biomarker Selection | High | Acceptable biomarker. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Ottawa, Canada. |
| | Metric 5: | Currency | Medium | Samples collected between 2009 and 2010. |
| | Metric 6: | Spatial and Temporal Variability | High | >10 samples; replicates. |
| | Metric 7: | Exposure Scenario | Medium | Exposure source characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not provided. |
| | Metric 9: | Quality Assurance | High | Key QA reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Limitations reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Mandin, C., Mercier, F., Rarnalho, O., Lucas, J. P., Gilles, E., Blanchard, O., Bonvallot, N., Glorennec, P., Le Bot, B. (2016). Semi-volatile organic compounds in the particulate phase in dwellings: A nationwide survey in France. Atmospheric Environment 136:82-94. |
| **HERO ID:** | 3230506 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling is detailed in Section 2.1. |
| | Metric 2: | Analytical Methodology | Medium | no recovery samples, but analytical method was previously validated |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers were not assessed nor relevant for this study. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | This study was located in France. |
| | Metric 5: | Currency | Medium | sampling took place from October 2003 to December 2005 |
| | Metric 6: | Spatial and Temporal Variability | Medium | no replicate samples, but used continuous air sampling methods over a period of one-week |
| | Metric 7: | Exposure Scenario | Medium | limited characterization of building characteristics and other microenvironmental factors |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | no raw data reported |
| | Metric 9: | Quality Assurance | Medium | no recovery samples, but used field blank samples; the analytical method was previously validated; no issues were identified |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | no discussion of limitations or data uncertainties |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Laborie, S., Moreau-Guigon, E., Alliot, F., Desportes, A., Oziol, L., Chevreuil, M. (2016). A new analytical protocol for the determination of 62 endocrine-disrupting compounds in indoor air. Talanta 147:132-141. |
| **HERO ID:** | 3230514 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling procedure, matrix characterization were described in detail. The study lacked a few details about storage conditions. |
| | Metric 2: | Analytical Methodology | High | TBBPA was analyzed by LC/MA; the other chemicals were analyzed by GC/MS. LOD was reported in SI. |
| | Metric 3: | Biomarker Selection | N/A | The authors analyzed environmental samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | 4 indoor environments in Paris. |
| | Metric 5: | Currency | Medium | 2013 |
| | Metric 6: | Spatial and Temporal Variability | Low | The samples came from 4 indoor environments. |
| | Metric 7: | Exposure Scenario | High | Indoor air |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Average concentrations were reported in Table 5. |
| | Metric 9: | Quality Assurance | Low | Quality assurance was not directly discussed but assumed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The main discussion on limitation and variability were about the analytical method. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Gani, K. M., Kazmi, A. A. (2016). Comparative assessment of phthalate removal and risk in biological wastewater treatment systems of developing countries and small communities. Science of the Total Environment 569-570:661-671. |
| **HERO ID:** | 3350189 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methods for wastewater and sludge from 3 WWTP were described in detail. This included the study site characteristics such as the processes and descriptions of each WWTP. The study also described the sampling equipment, procedures, and storage thoroughly. |
| | Metric 2: | Analytical Methodology | High | Analytical methods were described thoroughly in text, including the extraction method, analytical instrumentation, instrument calibration, recoveries for wastewater samples, and the LOD and LOQ. Detection limits and recovery were also reported in Table 2. |
| | Metric 3: | Biomarker Selection | N/A | This study tested for the parent chemical in wastewater and sludge. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study takes place in India. |
| | Metric 5: | Currency | High | Samples were collected from October 2014 to September 2015. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Wastewater and sludge samples were collected from October 2014 to September 2015, with a sampling frequency of one month. Sample size for each scenario ranged from 6 to 21. No replicate samples were reported. |
| | Metric 7: | Exposure Scenario | High | The data represent untreated wastewater influent, sludge, and treated effluent from three wastewater treatment plants. The effluents of these wastewater treatment plants are discharged to rivers which are important drinking water sources for people living nearby. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Detailed summary statistics of the untreated wastewater influent and sludge samples across seasons including the number of samples, range, mean, standard deviation, and detection frequency are reported in Table 3. Mean concentrations and standard deviation of treated effluents by season are reported in Table 4. Individual sample concentrations are not reported. |
| | Metric 9: | Quality Assurance | High | Quality assurance of the analysis method was done according to the EPA method 606 and recoveries were reported in Table S1. The study also reported that with every analysis, one blank sample of distilled water was analyzed to correct for laboratory contamination. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | The study characterizes variability by reporting the range and standard deviation of concentrations. Limitations were discussed in Section 3.8. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Lenoir, A., Boulay, R., Dejean, A., Touchard, A., Cuvillier-Hot, V. (2016). Phthalate pollution in an Amazonian rainforest. Environmental Science and Pollution Research 23(16):16865-16872. |
| **HERO ID:** | 3350198 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling sites were shown and characterized. Some methods were explained, but missing information about sample storage conditions. |
| | Metric 2: | Analytical Methodology | Low | LOD/LOQs were not reported. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in ants. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted in French Guiana. |
| | Metric 5: | Currency | Medium | Samples were collected in 2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Nearly 300 ants were samples without replicates. |
| | Metric 7: | Exposure Scenario | High | Sources of phthalate exposures to ants in pristine environments were described. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data were provided. |
| | Metric 9: | Quality Assurance | Medium | Some discussion of QA/QC techniques was provided. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variance not characterized, and uncertainties/limitations were not described. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Watkins, D. J., Milewski, S., Domino, S. E., Meeker, J. D., Padmanabhan, V. (2016). Maternal phthalate exposure during early pregnancy and at delivery in relation to gestational age and size at birth: A preliminary analysis. Reproductive Toxicology 65:59-66. |
| **HERO ID:** | 3350206 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some methods not reported such as sample storage conditions and sampler calibration. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported. |
| | Metric 3: | Biomarker Selection | High | Acceptable biomarker. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | USA |
| | Metric 5: | Currency | Medium | Samples collected between 2009 and 2012. |
| | Metric 6: | Spatial and Temporal Variability | High | >10 samples; with replicates. |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | raw data not reported. |
| | Metric 9: | Quality Assurance | Medium | Limited QA reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Gaps and limitations reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Pan, Y., Jing, J., Yeung, L. W., Sheng, N., Zhang, H., Yao, B., Dai, J. (2016). Associations of urinary 5-methyl-2'-deoxycytidine and 5-hydroxymethyl-2'-deoxycytidine with phthalate exposure and semen quality in 562 Chinese adult men. Environment International 94:583-590. |
| **HERO ID:** | 3350210 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported. Sampling approaches described, materials, and population description described. |
| | Metric 2: | Analytical Methodology | High | key analytical methods reported |
| | Metric 3: | Biomarker Selection | High | Acceptable biomarker |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | Samples collected between 2014 and 2015 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure scenario not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported |
| | Metric 9: | Quality Assurance | High | Analytical QA reported, more details in supplemental. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Gaps and limitations reported |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Ferguson, K. K., Meeker, J. D., Cantonwine, D. E., Chen, Y. H., Mukherjee, B., Mcelrath, T. F. (2016). Urinary phthalate metabolite and bisphenol A associations with ultrasound and delivery indices of fetal growth. Environment International 94(Elsevier):531-537. |
| **HERO ID:** | 3350218 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some sampling methods not reported such as sample storage conditions and sampler calibration |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported |
| | Metric 3: | Biomarker Selection | High | Acceptable biomarker |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Boston, MA |
| | Metric 5: | Currency | Medium | Samples collected from 2006 to 2012 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported |
| | Metric 9: | Quality Assurance | Medium | Limited QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Some limitations reported |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Tiwari, M., Sahu, S. K., Pandit, G. G. (2016). Distribution and estrogenic potential of endocrine disrupting chemicals (EDCs) in estuarine sediments from Mumbai, India. Environmental Science and Pollution Research 23(18):18789-18799. |
| **HERO ID:** | 3350221 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods (e.g., location, equipment, storage) were reported. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods (e.g., extraction, instrumentation, LODs) were reported. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in surface sediment. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Mumbai, India. |
| | Metric 5: | Currency | Medium | Samples were collected in 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | At least 3 samples were collected from each of 10 sampling locations. However, it is unclear if that means triplicate samples or collection at different depths. |
| | Metric 7: | Exposure Scenario | High | Exposure sources are broadly described in the introduction and study area. The population of interest was not described though. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Raw data were not reported, and most summary statistics were missing. |
| | Metric 9: | Quality Assurance | High | QA/QC techniques were reported, including recoveries that were acceptable. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Gaps and limitations were not reported. Variance was not characterized. |

## Overall Quality Determination Medium

**Study Citation:** Strømmen, K., Lyche, J. L., Blakstad, E. W., Moltu, S. J., Veierød, M. B., Almaas, A. N., Sakhi, A. K., Thomsen, C., Nakstad, B., Brække, K., Rønnestad, A. E., Drevon, C. A., Iversen, P. O. (2016). Increased levels of phthalates in very low birth weight infants with septicemia and bronchopulmonary dysplasia. Environment International 89-90:228-234.

**HERO ID:** 3350320

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The study included description of when samples were collected, how they were stored and how they were analyzed. It also included quality control samples. |
| | Metric 2: | Analytical Methodology | Medium | The study included internal standards, LOQ, percentages representing accuracy of the method, and, for confirmation ofphthalate metabolites, both retention time and qualifier ratio wereused. It is not completely clear how "accuracy of the method" was calculated. Analysis was by on-line column switching liquid chromatography coupled to tandem mass spectrometry. |
| | Metric 3: | Biomarker Selection | Medium | Metabolites were described and measured for each chemical. Samples were from urine and were not adjusted for creatinine or specific weight. Multiple metabolites were summed for compounds with multiple metabolites. One metabolite could be a metabolite of either DBP or BBP; no effort was made to apportion it. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Norway |
| | Metric 5: | Currency | Medium | The study was conducted in 2010. |
| | Metric 6: | Spatial and Temporal Variability | Low | While there were more than 110 samples, collected in weeks 1, 3, and 5 of life (approx. 35 in each timeframe), they were un-pooled urine spot samples. |
| | Metric 7: | Exposure Scenario | High | The data closely represent a relevant exposure scenario - no concerns were found. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data were provided, only geometric means, medians, minima, maxima and LOQ. |
| | Metric 9: | Quality Assurance | Low | QA/QC discussed was limited to a reference to quality control samples; reported ranges of "accuracies of the method," and using both retention time and qualifier ratio to confirm phthalate metabolites). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No discussion of variability or uncertainty was included. Some degree of variability was shown by minimum and maximum detection of urinary phthalate metabolites, but standard deviations are absent. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Eremina, N., Paschke, A., Mazlova, E. A., Schüürmann, G. (2016). Distribution of polychlorinated biphenyls, phthalic acid esters, polycyclic aromatic hydrocarbons and organochlorine substances in the Moscow River, Russia. Environmental Pollution 210:409-418. |
| **HERO ID:** | 3350341 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported. |
| | Metric 2: | Analytical Methodology | Medium | Recovery samples not reported. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Moscow River, Russia |
| | Metric 5: | Currency | Medium | Samples collected October 2013. |
| | Metric 6: | Spatial and Temporal Variability | Low | <5 samples; no replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Individual sample concentrations and statistics reported. |
| | Metric 9: | Quality Assurance | High | Key QA reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited gaps and limitations reported. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Liu, B., Li, Y., Ma, J., Huang, L., Chen, L. (2016). Detection of semi-volatile organic compounds (SVOCs) in surface water, soil, and groundwater in a chemical industrial park in Eastern China. Water Science and Technology 73(5):1175-1189. |
| **HERO ID:** | 3350971 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Surface water samples were collected from the outlets of an industrial wastewater treatment plant and a sewage ditch, groundwater samples from irrigation wells at various depths across the site, andsoil samples at the surface water sampling locations (Fig 1 and Table 1). Water samples were placed in1L glass bottles and shipped on ice within 24 hrs to lab. Soil samples of 1kg were collected by foil encasement, sealed in bag, and stored at 4C. Methodology followed China Geological Survey standard sampling procedures. |
| | Metric 2: | Analytical Methodology | High | Tables 2 and 3 showed the US EPA methods that were followed. Recoveries were acceptable. MDLs were provided in the SI. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected from Eastern China. |
| | Metric 5: | Currency | Low | Sampling date was not provided, but publication date is 2016. Authors did not that this is a continuation of a paper published in 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 20 samples were collected (7 surface water, 9 groundwater, and 4 soil - Table 1). Replicates and time period of sampling were not reported. |
| | Metric 7: | Exposure Scenario | High | The analysis of phthalates in surface water, groundwater, and soil within a chemical industrial park is relevant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Tables 4, 5, and S1-4 provide summary statistics. Raw data were not available. |
| | Metric 9: | Quality Assurance | High | QA/QC techniques were provided in p. 1778-1779, including blanks and recoveries (all within satisfactory range). Authors followed EPA method 8270D and 8000B. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited discussion of uncertainties, limitations, and data gaps |
| **Overall Quality Determination** | | | **High** | |

| | |
|---|---|
| **Study Citation:** | Wang, L., Zhang, W., Tao, W., Wang, L., Shi, X., Lu, X. (2016). Investigating into composition, distribution, sources and health risk of phthalic acid esters in street dust of Xi'an City, Northwest China. Environmental Geochemistry and Health 39(4):865-877. |
| **HERO ID:** | 3355406 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Dust samples. Sampling equipment and methods are described in sufficient detail, but certain aspects (e.g. component materials of sampling equipment) were absent that may have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | High | Analytical instrumentation and methods are described in sufficient detail and are scientifically sound; LOD is reported for each analyte. |
| | Metric 3: | Biomarker Selection | N/A | This study is testing for the parent chemical of interest in an environmental medium. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | High | December 2014-January 2015 |
| | Metric 6: | Spatial and Temporal Variability | High | Composite grab samples of street dust from 58 sampling sites |
| | Metric 7: | Exposure Scenario | High | Each street dust sampling site was categorized under one of six different urban functional categories |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data are not reported; summary statistics include minimum, maximum, mean and standard deviation of concentration at each site. |
| | Metric 9: | Quality Assurance | High | QA/QC measures included the use of blanks and recovery experiments; recoveries for both surrogate standards and matrix addition standards were within acceptable limits. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Standard deviation is reported to characterize variability. Spatial variability is analyzed, but there is little discussion of limitations or sources of uncertainty. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Botton, J., Philippat, C., Calafat, A. M., Carles, S., Charles, M. A., Slama, R. (2016). Phthalate pregnancy exposure and male offspring growth from the intra-uterine period to five years of age. Environmental Research 151:601-609. |
| **HERO ID:** | 3444888 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Participant selection described previously, urine collection described. |
| | Metric 2: | Analytical Methodology | Medium | LOD provided, analyses performed by CDC. |
| | Metric 3: | Biomarker Selection | High | Metabolite in urine. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | France |
| | Metric 5: | Currency | Low | 2003-2006 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 520, no replicates. |
| | Metric 7: | Exposure Scenario | High | Biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | 5th, 25th, 50th, 75th, 95th standardized and non-standardized concentrations 5th, 50th, and 95th included. |
| | Metric 9: | Quality Assurance | Low | QA not discussed, no obvious concerns. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and uncertainty not discussed, no obvious concerns. |

## Overall Quality Determination Medium

**Study Citation:** Schwarz, S., Rackstraw, A., Behnisch, P. A., Brouwer, A., Koehler, H. R., Kotz, A., Kuballa, T., Malisch, R., Neugebauer, F., Schilling, F., Schmidt, D., von Der Trenck, K. T. (2016). Peregrine falcon egg pollutants Mirror Stockholm POPs list including methylmercury. Toxicological and Environmental Chemistry 98(8):886-923.

**HERO ID:** 3449771

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling methods were not described well. Failed wild peregrine falcon eggs were collected by amateur ornithologists, in the process of ”caring for” breeding wild peregrine falcon pairs. Storage of eggs is not discussed, and study site characteristics are not described. |
| | Metric 2: | Analytical Methodology | Medium | GC-EC-MS. For a description of methods, readers are referred to other publications. The LOQ were provided for each chemical, time period, and lab. |
| | Metric 3: | Biomarker Selection | N/A | Parent substances were measured in the egg contents. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Germany |
| | Metric 5: | Currency | Medium | 2009-2010 |
| | Metric 6: | Spatial and Temporal Variability | Low | Sample size was not reported. No replicates were reported. |
| | Metric 7: | Exposure Scenario | High | Samples were from peregrine falcon eggs. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Raw data are absent, and summary statistics are not provided. The only reference to results for this chemical are in the text on page 913, where it says the chemicals not found were ”phthalic esters (<1 mg/g), except for traces of DEHP.” We do know from Table 1 which phthalates the samples were analyzed for. |
| | Metric 9: | Quality Assurance | Low | QA/QC was not discussed at all. Methods were not discussed in detail in this paper, but were laid out in other papers. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and uncertainty were not discussed, and there were no obvious sources of uncertainty. There is a passing reference to collection of eggs occurring at varying intervals after they were laid. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Jeddi, M. Z., Rastkari, N., Ahmadkhaniha, R., Yunesian, M. (2016). Endocrine disruptor phthalates in bottled water: daily exposure and health risk assessment in pregnant and lactating women. Environmental Monitoring and Assessment 188(9):534. |
| **HERO ID:** | 3454705 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Pertinent key aspects of the sampling methods were reported. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods were reported. The paper states the LODs and LOQs for the target analytes ranged from 0.01 to 0.025 and 0.025 to 0.05 ppb, respectively. The paper asserts that the methods were validated by FDA. |
| | Metric 3: | Biomarker Selection | N/A | The study analyzed chemicals in drinking water. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Iran |
| | Metric 5: | Currency | Medium | Samples were collected primarily in 2012. |
| | Metric 6: | Spatial and Temporal Variability | Medium | There were 24 samples of each brand of bottled water exposed to six different conditions (including 5 different temperatures) and left on the roof for four separate periods of time. The only replicates mentioned were in the QC samples, not the bottled water samples. |
| | Metric 7: | Exposure Scenario | High | Exposure represents bottles of water stored at various temperatures. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | The mean and standard deviations are reported for water bottles stored in different conditions (and for different brands of water, in a separate table). Raw data are not reported. |
| | Metric 9: | Quality Assurance | Low | The only quality assurance discussed is QA of the calibration method and some corrections employed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | A few limitations of the study were reported. Some variability is revealed via reporting of standard deviations. In addition, average concentrations overall across different brands of water were presented. There was limited to no discussion of uncertainties, particularly given the corrections employed, including to "get rid of interference due to residual phthalates." |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Sampath, S., Selvaraj, K. K., Shanmugam, G., Krishnamoorthy, V., Chakraborty, P., Ramaswamy, B. R. (2016). Evaluating spatial distribution and seasonal variation of phthalates using passive air sampling in southern India. Environmental Pollution 221:407-417. |
| **HERO ID:** | 3455107 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Detailed sampling methodology, scientifically sound. Description of sampling region and maps provided. |
| | Metric 2: | Analytical Methodology | High | Analysis was done using gas chromatography mass spectrometry. Provides extraction details, instrumentation, LOD and LOQ. Analytical QC samples described and reported, blanks, internal standards (recoveries), and blank subtraction for DEHP and DBP. |
| | Metric 3: | Biomarker Selection | N/A | NA - air samples no biomarker needed. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | India |
| | Metric 5: | Currency | Medium | Sampling in 2009-2010 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 31 sampling locations, sampled during 3 seasons. The total number of samples is not stated |
| | Metric 7: | Exposure Scenario | High | Microenvironment and potential sources are described |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual sampling concentrations not reported, only summary statistics |
| | Metric 9: | Quality Assurance | Medium | Well described QA/QC, missing field blank analysis |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Key uncertainties and limitations are briefly discussed. Temporal and location variability discussed. Source of uncertainty to the measurements from analytical and sampling approaches addressed. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Giovanoulis, G., Alves, A., Papadopoulou, E., Cousins, A. P., Schütze, A., Koch, H. M., Haug, L. S., Covaci, A., Magnér, J., Voorspoels, S. (2016). Evaluation of exposure to phthalate esters and DINCH in urine and nails from a Norwegian study population. Environmental Research 151:80-90. |
| **HERO ID:** | 3455194 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling was only briefly described, but reference to previous study (Papadopoulou et al., 2016) was provided. |
| | Metric 2: | Analytical Methodology | High | Pertinent analytical methods (e.g., extraction, instrumentation, LOQs) were provided in both main paper and SI. |
| | Metric 3: | Biomarker Selection | High | Metabolite is specific to BBP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted in Norway. |
| | Metric 5: | Currency | Medium | Samples were collected during 2013-2014. |
| | Metric 6: | Spatial and Temporal Variability | Low | About 60 samples were collected without replicates, and unpooled spot urine samples were analyzed. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study where exposure is presumed to occur via numerous consumer products. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not provided. |
| | Metric 9: | Quality Assurance | Low | Only some QA (e.g., spike and blank samples) were discussed in SI. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Uncertainties, limitations, and gaps were not discussed. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Sun, J., Pan, L., Tsang, D. C., Li, Z., Zhu, L., Li, X. (2016). Phthalate esters and organochlorine pesticides in agricultural soils and vegetables from fast-growing regions: a case study from eastern China. Environmental Science and Pollution Research 25(1):34-42. |
| **HERO ID:** | 3455519 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methods are discussed in moderate detail, but certain aspects (e.g. equipment to collect soil, duration of storage until analysis) are missing. These are unlikely to substantially impact results. |
| | Metric 2: | Analytical Methodology | Low | Analytical instrumentation and methods are described in sufficient detail, but LOD is only reported as a range for all analyzed phthalate esters. |
| | Metric 3: | Biomarker Selection | N/A | This study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted in Eastern China. |
| | Metric 5: | Currency | Medium | Samples were collected in 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Sampling consisted of 26 pairs of topsoil and cabbage evenly distributed across the area of interest with five subsamples for each sample type, as well as three vertical soil profiles. However, it is unclear if those subsamples were replicates or not. |
| | Metric 7: | Exposure Scenario | High | Samples are taken from vegetables collected from agricultural fields and agricultural soil, which are likely representative of general population exposure. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No individual data points were provided. Summary statistics for concentration include minimum, maximum, mean, SD, and percent of samples above LOD. |
| | Metric 9: | Quality Assurance | High | QA methods included procedural blank, spiked blank, and sample duplicate processing with every batch of ten samples. No major issues were identified; concentrations of all phthalate esters were blank corrected, and spike recovery rates were between 77.6-108.5%. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Standard deviation of concentration was reported, but the value indicates high variability which was not addressed. Other aspects of variability or uncertainty were minimally discussed. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Ouyang, X., Weiss, J. M., de Boer, J., Lamoree, M. H., Leonards, P. E. (2017). Non-target analysis of household dust and laundry dryer lint using comprehensive two-dimensional liquid chromatography coupled with time-of-flight mass spectrometry. Chemosphere 166:431-437. |
| **HERO ID:** | 3455857 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Dust sample not fully specified. |
| | Metric 2: | Analytical Methodology | Low | LOD or LOQ not reported |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Uppsala, Sweden and Netherlands |
| | Metric 5: | Currency | Low | The timing of collection is not specified but references available (Ouyang et al., 2015) and (Ouyang et al., 2016). |
| | Metric 6: | Spatial and Temporal Variability | Medium | Five dust samples and six dryer lint samples |
| | Metric 7: | Exposure Scenario | High | Exposure to household dust |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data reported |
| | Metric 9: | Quality Assurance | Medium | Deviation, recovery and quality control issues discussed. No control samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Accuracy of the analytical technique reported but variability and uncertainty not clearly discussed. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Huang, H. B., Pan, W. H., Chang, J. W., Chiang, H. C., Guo, Y. L., Jaakkola, J. J., Huang, P. C. (2017). Does exposure to phthalates influence thyroid function and growth hormone homeostasis? The Taiwan Environmental Survey for Toxicants (TEST) 2013. Environmental Research 153(6):63-72. |
| **HERO ID:** | 3466596 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampled population, methods, equipment, storage samples all reported. |
| | Metric 2: | Analytical Methodology | High | Analytical methods, instrument and LOD reported. |
| | Metric 3: | Biomarker Selection | High | Biomarker is known to have a relationship with external exposure. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in Taiwan. |
| | Metric 5: | Currency | Medium | Samples were taken from 2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 358 in total: 279 adults, 79 minors. No replicates. |
| | Metric 7: | Exposure Scenario | High | Data closely represent relevant exposure scenarios, including a questionnaire to identify possible exposures. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics reported. Individual points not reported. |
| | Metric 9: | Quality Assurance | Low | Analyzed control samples, limited description of QA/QC techniques. Recoveries not reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Characterized variability through different participants sampled. Discussed uncertainties and limitations. |
| **Overall Quality Determination** | | | **High** | |

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|---|---|
| **Study Citation:** | Gyllenhammar, I., Glynn, A., Jönsson, B. A., Lindh, C. H., Darnerud, P. O., Svensson, K., Lignell, S. (2017). Diverging temporal trends of human exposure to bisphenols and plastizisers, such as phthalates, caused by substitution of legacy EDCs?. Environmental Research 153:48-54. |
| **HERO ID:** | 3466597 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Recruitment described briefly and refers to Glynn et al., 2007. Sampling described briefly. Morning spot urine samples weresampled by the mothers themselves in a glass bottle three weeks after delivery and the samples were thereafter stored at −20 °C. Missing approaches to avoid contamination, other than glass bottles. |
| | Metric 2: | Analytical Methodology | Medium | Methods described in Bornehag et al., 2015 and briefly described in the paper, LOD provided. Used liquid chromatography tandem mass spectrometry. |
| | Metric 3: | Biomarker Selection | High | metabolite in urine |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sweden |
| | Metric 5: | Currency | Medium | 2009-2014 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 174, no replicates |
| | Metric 7: | Exposure Scenario | High | biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary tables with mean, median, range, no raw data reported. |
| | Metric 9: | Quality Assurance | Medium | Blanks and controls included. LOD approach described. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Temporal trends and discussed, sources of uncertainty and variability within the measurements not discussed. Spot urine samples are not ideal for assessing temporal trends. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Wu, W., Zhou, F., Wang, Y., Ning, Y., Yang, J. Y., Zhou, Y. K. (2017). Exposure to phthalates in children aged 5-7years: Associations with thyroid function and insulin-like growth factors. Science of the Total Environment 579:950-956. |
| **HERO ID:** | 3466600 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Study population briefly described, urine sample collection described |
| | Metric 2: | Analytical Methodology | Medium | Methods described by Specht et al. (2015), LOD provided in Table S1. |
| | Metric 3: | Biomarker Selection | High | Metabolite in urine |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | 2013 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 216, no replicates |
| | Metric 7: | Exposure Scenario | High | Biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | GM (geometric mean), 5th, 25th, 50th, 75th, 95th reported |
| | Metric 9: | Quality Assurance | Medium | Recovery in SI, blanks and QC in all batches included |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Wu, W., Zhou, F., Wang, Y., Ning, Y., Yang, J. Y., Zhou, Y. K. (2017). Phthalate levels and related factors in children aged 6-12 years. Environmental Pollution 220(Pt B):990-996. |
| **HERO ID:** | 3469193 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methods, instrument, storage and study population all reported. |
| | Metric 2: | Analytical Methodology | High | Analytical methods, instrument and LOD reported. |
| | Metric 3: | Biomarker Selection | High | Biomarker is known to be related with external exposure. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study site is China. |
| | Metric 5: | Currency | Medium | Sampling was conducted from January 2014 to July 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 336 total samples from children. No replicates reported. |
| | Metric 7: | Exposure Scenario | Medium | Data was collected from China in 2014 and the exact source of the exposures are unclear. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics reported. Raw data not reported. |
| | Metric 9: | Quality Assurance | Medium | QA procedures was reported to be used, however, there is no details of it. Recovery was >90%. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Characterized variability, did not discuss uncertainties and limitations. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Al-Saleh, I., Elkhatib, R., Al-Rajoudi, T., Al-Qudaihi, G. (2017). Assessing the concentration of phthalate esters (PAEs) and bisphenol A (BPA) and the genotoxic potential of treated wastewater (final effluent) in Saudi Arabia. Science of the Total Environment 578:440-451. |
| **HERO ID:** | 3469247 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Saudi Arabia |
| | Metric 5: | Currency | Low | Study published in 2017 |
| | Metric 6: | Spatial and Temporal Variability | High | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not provided |
| | Metric 9: | Quality Assurance | Medium | Limited QA/QC reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited gaps and limitations |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Choi, W., Kim, S., Baek, Y. W., Choi, K., Lee, K., Kim, S., Yu, S. D., Choi, K. (2016). Exposure to environmental chemicals among Korean adults-updates from the second Korean National Environmental Health Survey (2012-2014). International Journal of Hygiene and Environmental Health 220(2 Pt A):29-35. |
| **HERO ID:** | 3469260 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling procedure was described in details, including equipment, storage, and population characteristics. |
| | Metric 2: | Analytical Methodology | High | Analytical procedure was described. HPLC–MS/MS was used. LODs were reported for individual metabolite: MEHHP, MEOHP, MECPP, MBzP, and MnBP were determined at 0.28, 0.26, 0.34, 0.27, and 0.44 $\mu$g/L, respectively (reported in same cohort study with HERO: 3515110). |
| | Metric 3: | Biomarker Selection | High | Biomarker (metabolite) is derived from exposure to the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted in Korea. |
| | Metric 5: | Currency | Medium | The sampling was conducted from 2012 to 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | In total 6478 samples were collected without replicates. Note that replicates may not be relevant in this study though. |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant exposure scenario. The sample information included the products used. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Supplementary or raw data are not reported, and therefore summary statistics cannot be reproduced. |
| | Metric 9: | Quality Assurance | Medium | QA/QC measures were not explicitly discussed, but authors noted the procedures they followed which was published by authoritative sources in Korea and Germany. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | There was some discussion of key uncertainties, limitations, and data gaps have been identified. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Dereumeaux, C., Saoudi, A., Pecheux, M., Berat, B., de Crouy-Chanel, P., Zaros, C., Brunel, S., Delamaire, C., le Tertre, A., Lefranc, A., Vandentorren, S., Guldner, L. (2016). Biomarkers of exposure to environmental contaminants in French pregnant women from the Elfe cohort in 2011. Environment International 97:56-67. |
| **HERO ID:** | 3469298 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Samples were collected according to the protocols defined and validated by a pilot study in 2007, including materials and storage conditions. |
| | Metric 2: | Analytical Methodology | High | Analytical method, LOD, LOQ and Intra day precision are reported in Table 2. Instrument provided also. Analytical performances of biomarker measurements realized in the perinatal component of the French HBM program. |
| | Metric 3: | Biomarker Selection | High | The biomarkers were selected owing to the biomonitoring feasibility, the exposure relevance, the existing regulations for the compounds, and the priorities in terms of health effects. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | National scale monitoring in France. |
| | Metric 5: | Currency | Medium | 2011 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Large sample size, sampling from June to November. No sample replicates. Spot urine samples taken. |
| | Metric 7: | Exposure Scenario | High | The primary aim of the perinatal component of the French HBM program was to describe internal concentrations of environmental contaminants among pregnant women having given birth in continental France in 2011. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual sample concentrations are not reported. Descriptive statistical analyses for each biomarker included: the geometric mean, median, 25th, 75th and 95th percentiles in Table 4. |
| | Metric 9: | Quality Assurance | Low | Laboratory blanks and QC samples (spiked samples) were introduced into each batch of samples (every 10 samples) to verify the accuracy and precision of the measurements at, at least, three concentration levels within the measurement range. No field control samples. Recoveries not reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | The study characterizes variability in the community sampled and reports weakness and limitations of the study. |

## Overall Quality Determination High

**Study Citation:** Müllerová, D., Bouchalová, V., Matějková, D., Kovářová, K., Svačina, Š., Vrbík, K., Pavloušková, J., Dvořáková, J., Müller, L. (2016). Phthalates exposure indicators determined by urinary phthalate metabolites in healthy non-obese Czech adults: FANTOM study. Food Additives & Contaminants: Part A, Chemistry, Analysis, Control, Exposure & Risk Assessment 33(12):1817-1825.

**HERO ID:** 3469309

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods (e.g., participant characteristics, urine collection schedule, storage conditions) were reported. |
| | Metric 2: | Analytical Methodology | Low | LODs/LOQs were not reported. |
| | Metric 3: | Biomarker Selection | High | Metabolite is specific to BBP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted in Czech Republic. |
| | Metric 5: | Currency | Medium | Samples were collected in 2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Samples were collected from 201 adults without replicates. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study that aimed to characterize associations between various consumer products, fruits, and meats and urine metabolite levels. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. |
| | Metric 9: | Quality Assurance | Low | QA/QC techniques were not reported but can be implied through its use of an accredited laboratory that participated in previous quality assessments. References were provided. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations were reported. |
| **Overall Quality Determination** | | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | James-Todd, T. M., Meeker, J. D., Huang, T., Hauser, R., Ferguson, K. K., Rich-Edwards, J. W., Mcelrath, T. F., Seely, E. W. (2016). Pregnancy urinary phthalate metabolite concentrations and gestational diabetes risk factors. Environment International 96:118-126. |
| **HERO ID:** | 3469326 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | enrollment described, urine collection described |
| | Metric 2: | Analytical Methodology | Low | All phthalate metabolites were analyzed by National Science Foundation International, Inc. (Ann Arbor, MI) using protocol from the Centers for Disease Control and Prevention described elsewhere (Ferguson et al., 2014a; CDC. (Centers for Disease Control and Prevention), 2005). LOD not provided. |
| | Metric 3: | Biomarker Selection | High | metabolite in urine |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Boston, U.S. |
| | Metric 5: | Currency | Medium | 2006-2008 |
| | Metric 6: | Spatial and Temporal Variability | High | N = 350 |
| | Metric 7: | Exposure Scenario | High | biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | GM, 25th, 75th |
| | Metric 9: | Quality Assurance | Low | QA not discussed, no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability captured by different demographic groups; uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Alves, A., Covaci, A., Voorspoels, S. (2016). Are nails a valuable non-invasive alternative for estimating human exposure to phthalate esters?. Environmental Research 151:184-194. |
| **HERO ID:** | 3469351 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Missing nail sampling descriptions, assumed it was by clipping nail tips and storing clips in some container (not described) and materials used to collect nail and urine samples, also missed approaches to avoid phthalate contamination during sample. |
| | Metric 2: | Analytical Methodology | Medium | Analytical methods described, Limits reported under Table 1 per chemical. |
| | Metric 3: | Biomarker Selection | High | metabolite in nails and urine |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Belgium |
| | Metric 5: | Currency | High | 2015 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Nail samples n = 20, urine samples n = 16, no replicates |
| | Metric 7: | Exposure Scenario | High | biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | GM, detection frequency, min, max, 25th, median, 75th, 95th |
| | Metric 9: | Quality Assurance | Medium | QA discussed including blanks, calibration standards, and LOQ methods. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | variability discussed briefly, uncertainty not discussed, no obvious concerns |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Doherty, B. T., Engel, S. M., Buckley, J. P., Silva, M. J., Calafat, A. M., Wolff, M. S. (2017). Prenatal phthalate biomarker concentrations and performance on the Bayley Scales of Infant Development-II in a population of young urban children. Environmental Research 152(Elsevier):51-58. |
| **HERO ID:** | 3469358 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Enrollment and sample collection were described, but missing details such as equipment and collection regimen. |
| | Metric 2: | Analytical Methodology | Medium | Analytical methods were not described but referenced publications where it was: Silva et al., 2008; Kato et al., 2005. LODs were provided. |
| | Metric 3: | Biomarker Selection | High | Metabolite is specific to BBP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study conducted in U.S. (New York). |
| | Metric 5: | Currency | Low | Samples were collected during 1998-2002. |
| | Metric 6: | Spatial and Temporal Variability | Low | Samples were collected from 258 participants without replicates. Spot unpooled urine samples were analyzed from mothers. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study that explained possible sources of exposure, as well as population of interest. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Geometric mean, standard error, and 50th and 95th percentiles were provided but not raw data. |
| | Metric 9: | Quality Assurance | Low | QA/QC was not discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Uncertainties, limitations, and gaps were not discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Saini, A., Okeme, J. O., Mark Parnis, J., Mcqueen, R. H., Diamond, M. L. (2016). From air to clothing: characterizing the accumulation of semi-volatile organic compounds to fabrics in indoor environments. Indoor Air 27(3):631-641. |
| **HERO ID:** | 3469466 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Study was missing some information such as sample matrix. Equipment for air sampling and collection intervals were described. A previously published paper was cited for further details on air sampling methods. |
| | Metric 2: | Analytical Methodology | Low | LOD/LOQs were not provided. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in air and fabric. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was performed in Canada. |
| | Metric 5: | Currency | Medium | Samples were collected in 2013. |
| | Metric 6: | Spatial and Temporal Variability | Low | Fabrics were deployed in 20 homes and 5 offices. Air samples were collected weekly for up to 56 days (or 28 - unclear). The study size was unclear, but enough information was provided to infer that there more than 10 samples. Replicates were occasionally collected over the study period. |
| | Metric 7: | Exposure Scenario | High | Exposure to phthalates via dermal contact with clothing and via inhalation of particles that partition to indoor air is relevant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Some concentration values and ranges were provided in text. Otherwise, most summary statistics and raw data were missing. |
| | Metric 9: | Quality Assurance | Medium | Blanks, recoveries, and references to other analytical methods for reproducibility were provided. However, recoveries were not reported for most phthalates of interest. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variance and limitations were not presented. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Tsai, H. J., Wu, C. F., Tsai, Y. C., Huang, P. C., Chen, M. L., Wang, S. L., Chen, B. H., Chen, C. C., Wu, W. C., Hsu, P. S., Hsiung, C. A., Wu, M. T. (2016). Intake of phthalate-tainted foods and serum thyroid hormones in Taiwanese children and adolescents. Scientific Reports 6:30589. |
| **HERO ID:** | 3469519 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Participants in this study provided one-spot urine samples which were aliquoted and stored in a freezer until measurement. No further details on methodology or equipment for sample collection were reported, which may have an impact on results. |
| | Metric 2: | Analytical Methodology | Medium | The study reported following analytical methodology that has been described in detail in other cited studies. Instrumentation was reported, but other details of the method were not described. Method detection limit was reported. |
| | Metric 3: | Biomarker Selection | High | The monoester phthalate metabolite of the parent chemical of interest is measured in urine, which is considered a highly reliable measure of current phthalate exposure. Concentration is further corrected for urine creatinine. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | This study was conducted with participants in Taiwan. |
| | Metric 5: | Currency | Medium | Study participants were collected between August 2012 and January 2013. |
| | Metric 6: | Spatial and Temporal Variability | Low | Single spot urine samples were collected from 240 study participants. Use of replicates was not reported. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study where exposure is presumed to occur through a deliberate addition of certain phthalates to foodstuffs, after which specific event, participants sought medical consultation and responded to a questionnaire designed to estimate exposure from this event. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. Summary statistics include minimum, median, maximum, and other percentiles of concentration of phthalate biomarker. |
| | Metric 9: | Quality Assurance | Low | QA/QC methods were not described but can be inferred from the use of standard laboratory protocols published in other studies. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Quantitative characterization of variability was reported by various percentiles of measured exposure. There is some discussion of limitations, including a time lag that may have resulted in recall bias when completing the exposure questionnaire. Further detail on exposure-specific limitations could have improved the score in this metric. |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | Moreau-Guigon, E., Alliot, F., Gasperi, J., Blanchard, M., Teil, M. J., Mandin, C., Chevreuil, M. (2016). Seasonal fate and gas/particle partitioning of semi-volatile organic compounds in indoor and outdoor air. Atmospheric Environment 147(Elsevier):423-433. |
| **HERO ID:** | 3470397 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods were reported. |
| | Metric 2: | Analytical Methodology | High | Acceptable analytical methods were reported |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | France |
| | Metric 5: | Currency | Medium | Samples collected in 2011 and 2012 |
| | Metric 6: | Spatial and Temporal Variability | High | 6 samples per indoor environment |
| | Metric 7: | Exposure Scenario | Medium | Exposure source was not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported |
| | Metric 9: | Quality Assurance | High | QA was reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Few gaps and limitations were reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Selvaraj, K. K., Mubarakali, H., Rathinam, M., Harikumar, L., Sampath, S., Shanmugam, G., Ramaswamy, B. R. (2016). Cumulative exposure and dietary risk assessment of phthalates in bottled water and bovine milk samples: A preliminary case study in Tamil Nadu, India. Human and Ecological Risk Assessment 22(5):1166-1182. |
| **HERO ID:** | 3479504 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | sampling described |
| | Metric 2: | Analytical Methodology | High | method described by Selvaraj et al. (2015). Equipment described. MDL and LOQ provided. |
| | Metric 3: | Biomarker Selection | N/A | environmental |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | India |
| | Metric 5: | Currency | High | Collected in 2015 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 21, no replicates |
| | Metric 7: | Exposure Scenario | Medium | water bottles and cow milk |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | maximum concentrations in Table 2, averages in Figure 1 and 2. No raw data. |
| | Metric 9: | Quality Assurance | High | Spike recovery, method blanks, calibration, MDL, and LOQ described. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | variability and uncertainty discussed using statistical analysis and PCA, unclear if the selected samples represent the general population or just specific locations. No obvious concerns |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Perng, W., Watkins, D. J., Cantoral, A., Mercado-García, A., Meeker, J. D., Téllez-Rojo, M. M., Peterson, K. E. (2017). Exposure to phthalates is associated with lipid profile in peripubertal Mexican youth. Environmental Research 154:311-317. |
| **HERO ID:** | 3515111 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Mothers provided a urine sample and completed interview-based questionnaires at up to three time points across pregnancy. re-contacted a subset of their offspring (n=250) who werethen 8–14 years of age to participate in follow-up studies. The children filled out an interview-based questionnaire, and provided urine and serum samples |
| | Metric 2: | Analytical Methodology | Low | Use high performance liquid chromatography and tandem mass-spectrometry methods described in detail elsewhere (Lewis et al., 2013; Silva et al., 2007). LOD not provided. |
| | Metric 3: | Biomarker Selection | High | metabolite in urine |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Mexico |
| | Metric 5: | Currency | Medium | 2010 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Study sample included 248 mother-child pairs with adequate maternal urine collected during pregnancy or child's urine during peripuberty. No replicates. |
| | Metric 7: | Exposure Scenario | High | Mother and child biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | mean and SD provided |
| | Metric 9: | Quality Assurance | Low | QA not discussed, no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Yang, J. F., Yang, L. M., Zheng, L. Y., Ying, G. G., Liu, C. B., Luo, S. L. (2017). Phthalates in plastic bottled non-alcoholic beverages from China and estimated dietary exposure in adults. Food Additives and Contaminants: Part B: Surveillance 10(1):44-50. |
| **HERO ID:** | 3515163 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methods were explained in some detail, but a few aspects of the sampling methods were not reported, such as sampler calibration. |
| | Metric 2: | Analytical Methodology | High | Key aspects of the analytical methods were reported, including limits of detection, instrumentation, recovery percentages, etc. |
| | Metric 3: | Biomarker Selection | N/A | Samples were of parent chemicals in liquids within plastic bottles. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | High | Samples were collected in 2015. |
| | Metric 6: | Spatial and Temporal Variability | High | There were 69 samples and two duplicates from each brand of beverage. |
| | Metric 7: | Exposure Scenario | High | The authors estimated the daily intake of six phthalates by the Chinese population from drinking bottled beverages, based on the data they collected. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported, but ranges, means, and medians were reported. |
| | Metric 9: | Quality Assurance | High | Key aspects of the QA/QC were reported, including recoveries, blanks, and duplicates. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Although a few limitations of the study were identified, key aspects of variability and uncertainty were not well characterized. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Chang, W. H., Wu, M. H., Pan, H. A., Guo, P. L., Lee, C. C. (2017). Semen quality and insulin-like factor 3: Associations with urinary and seminal levels of phthalate metabolites in adult males. Chemosphere 173:594-602. |
| **HERO ID:** | 3519878 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Urine, blood, and semen samples were collected from the malepartners of subfertile (n = 253) and fertile (n = 37) couples in a reproductive center in southern Taiwan. Sample collection described |
| | Metric 2: | Analytical Methodology | Medium | Analytical methodology used was LC-MS/MS and quality controls were driven as previously described (Chang et al., 2015), but briefly and adequately described. LOD in SI. Missing analytical QA/QC mention or brief description. |
| | Metric 3: | Biomarker Selection | High | metabolite in urine and semen |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Taiwan |
| | Metric 5: | Currency | Medium | 2010-2014 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 37, 124, and 129, no replicates; urine samples morning void |
| | Metric 7: | Exposure Scenario | High | biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | geometric mean and geometric mean SD |
| | Metric 9: | Quality Assurance | Low | QA not discussed, no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Rocha, B. A., Asimakopoulos, A. G., Barbosa, F., Kannan, K. (2017). Urinary concentrations of 25 phthalate metabolites in Brazilian children and their association with oxidative DNA damage. Science of the Total Environment 586:152-162. |
| **HERO ID:** | 3531624 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Limited description of sampling methodology. |
| | Metric 2: | Analytical Methodology | High | Well described analytical methods, reported LOD. |
| | Metric 3: | Biomarker Selection | High | Biomarkers are known to be related with external exposure. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Brazil |
| | Metric 5: | Currency | Medium | Samples from 2012-2013. |
| | Metric 6: | Spatial and Temporal Variability | Low | 300 samples, no replicates. |
| | Metric 7: | Exposure Scenario | High | Data closely represent relevant exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics only. |
| | Metric 9: | Quality Assurance | High | Detailed QA/QC techniques. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Characterized variability, did not discuss uncertainties and limitations. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Chen, C. F., Chen, C. W., Ju, Y. R., Dong, C. D. (2016). Determination and assessment of phthalate esters content in sediments from Kaohsiung Harbor, Taiwan. Marine Pollution Bulletin 124(2):767-774. |
| **HERO ID:** | 3540854 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Details of the sampling procedures, locations, and sample storage have been reported elsewhere (Dong et al., 2015a). Brief description: Surface sediment (0–15 cm) samples were collected at 20 sampling points. Missing mention of sampling efforts to avoid phthalate contamination from materials and person collecting sample. Description of sampling location and sites provided, and shown in Figure 1. |
| | Metric 2: | Analytical Methodology | High | Use gas chromatography mass spectrometry was used for the analysis of the samples. Five-point calibration curve (2 to 10 ng), procedural blank, check standard, sample duplicates, and certified reference materials were carried out for all samples. Detection limits reported. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Kaohsiung Harbor, Taiwan. |
| | Metric 5: | Currency | Medium | Samples collected in 2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 80 samples; no replicates. |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not provided. |
| | Metric 9: | Quality Assurance | High | Key QA reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Key gaps and limitations not well characterized. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Tordjman, K., Grinshpan, L., Novack, L., Göen, T., Segev, D., Beacher, L., Stern, N., Berman, T. (2016). Exposure to endocrine disrupting chemicals among residents of a rural vegetarian/vegan community. Environment International 97(Elsevier):68-75. |
| **HERO ID:** | 3540861 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Subjects then provided a spot urine sample. All collection and storage equipment was BPA and phthalate-free. Each subject filled in a detailed 61-item health, lifestyle and eating practice questionnaire, see supplemental. Key sampling methods reported, storage and contamination avoidance reported. |
| | Metric 2: | Analytical Methodology | Medium | The analytical procedure consisted of a multidimensional liquidchromatography tandem mass spectrometry method (LC-MS/MS). Some analytical methods not reported, such as recovery samples. LOD reported in supplemental information. |
| | Metric 3: | Biomarker Selection | Medium | Acceptable biomarker |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Israel |
| | Metric 5: | Currency | Medium | Samples collected in 2013 and 2014 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 42 Amirim residents (29 vegetarians/13 vegans; 24 women/18men; no replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure to phthalates from diet, although other sources not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | raw data not reported |
| | Metric 9: | Quality Assurance | Low | Limited QA reported. Some reported in the text and supplemental information, but missing calibration, recoveries, blanks. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Key limitations reported |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Chepchirchir, B. S., Paschke, A., Schüürmann, G. (2017). Passive sampling for spatial and temporal monitoring of organic pollutants in surface water of a rural-urban river in Kenya. Science of the Total Environment 601-602:453-460. |
| **HERO ID:** | 3841181 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Limited information on sample storage conditions to avoid contamination |
| | Metric 2: | Analytical Methodology | High | well described methods, reported detection limits and further details in supplementary material |
| | Metric 3: | Biomarker Selection | N/A | NA - surface water no biomarker needed |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Kenya |
| | Metric 5: | Currency | Medium | January - February 2014 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 7 sampling sites, sampled in two campaigns, no replicates. |
| | Metric 7: | Exposure Scenario | Low | Limited exposure relevant data e.g. population of interest and microenvironment |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | individual concentrations and summary statistics reported |
| | Metric 9: | Quality Assurance | High | Reported recoveries, analyzed field and laboratory controls |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Study provided a good level of characterization of variability, uncertainties and limitations |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Albar, H., Ali, N., Shahzad, K., Ismail, I. M. I., Rashid, M. I., Wang, W.,ei, Ali, L. N., Eqani, S. (2017). Phthalate esters in settled dust of different indoor microenvironments; Source of non-dietary human exposure. Microchemical Journal 132:227-232. |
| **HERO ID:** | 3859024 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Dust samples collected from three different microenvironments (cars, air conditioner (AC) filters and household floor dust) of Saudi Arabia (KSA) and Kuwait. Used vacuum cleaner to collect dust samples. Approaches to avoid contamination reported. More details in supplemental information. |
| | Metric 2: | Analytical Methodology | Medium | Some analytical methods not reported, such as recovery samples |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Saudi Arabia (KSA) and Kuwait |
| | Metric 5: | Currency | Medium | Data collected between 2011-12 (Saudi Arabia) and 2014-15 (Kuwait) |
| | Metric 6: | Spatial and Temporal Variability | Medium | Although replicates were not collected, samples were extracted in triplicate. |
| | Metric 7: | Exposure Scenario | High | Indoor dust environments cars, air conditioners, and household floor dust. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | raw data not reported |
| | Metric 9: | Quality Assurance | Medium | Analytical QA/QC was described, but not all reported, missing recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Uncertainty and variability sources discussed. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Ipapo, K. N., Factor-Litvak, P., Whyatt, R. M., Calafat, A. M., Diaz, D., Perera, F., Rauh, V., Herbstman, J. B. (2017). Maternal prenatal urinary phthalate metabolite concentrations and visual recognition memory among infants at 27 weeks. Environmental Research 155:14-Jul. |
| **HERO ID:** | 3859030 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | participants and sampling described briefly, spot urine samples from mothers |
| | Metric 2: | Analytical Methodology | Medium | methods previously described (Kato et al., 2005); LOD provided. |
| | Metric 3: | Biomarker Selection | High | metabolite in urine |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | U.S. |
| | Metric 5: | Currency | Low | 1998-2006 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 168, no replicates, urine spot samples |
| | Metric 7: | Exposure Scenario | High | biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | geometric mean, 95%CI, range, %<LOD, 25%, median, 75% |
| | Metric 9: | Quality Assurance | Low | QA not discussed, no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Lee, K. M., Kho, Y., Kim, P. G., Park, S. H., Lee, J. H. (2017). Urinary levels of phthalate metabolites and associations with demographic characteristics in Korean adults. Environmental Science and Pollution Research 24(17):14669-14681. |
| **HERO ID:** | 3859032 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most key criteria met. Duration of sample storage data lacking. |
| | Metric 2: | Analytical Methodology | Medium | Most key criteria met, chemical-specific LOD's reported. |
| | Metric 3: | Biomarker Selection | Low | Sampling for metabolites not specific for parent chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples provided by participants in South Korea. |
| | Metric 5: | Currency | High | Samples collected in 2009. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Sampling strategy based upon random sample of national census data, single spot urine samples collected, distributions across rural and urban, age group, gender and other demographics provided. |
| | Metric 7: | Exposure Scenario | Medium | Participant characteristics summarized, potential for occupational exposure described, lack of information on pre-exposure or control samples. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Most key criteria met; lack of raw data. |
| | Metric 9: | Quality Assurance | Medium | Quality assurance procedures minimally described with some key criteria met; lack of recovery data. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability characterized within summary statistics, potential study limitations, including occupational exposure, discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Chen, Q., Yang, H., Zhou, N., Sun, L., Bao, H., Tan, L., Chen, H., Ling, X., Zhang, G., Huang, L., Li, L., Ma, M., Yang, H., Wang, X., Zou, P., Peng, K., Liu, T., Shi, X., Feng, D., Zhou, Z., Ao, L., Cui, Z., Cao, J. (2017). Phthalate exposure, even below US EPA reference doses, was associated with semen quality and reproductive hormones: Prospective MARHCS study in general population. Environment International 104(Elsevier):58-68. |
| **HERO ID:** | 3859041 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampled participants, equipment and storage described. However, sampling methods are only briefly discussed, and missing detail may have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | High | Analytical instrumentation and methods are discussed in detail and are scientifically sound. LOD is reported. |
| | Metric 3: | Biomarker Selection | Medium | The monoester phthalate analyte is a metabolite of multiple parent chemicals, not just the chemical of interest, and there is not a stated method to apportion the estimate to only the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in China. |
| | Metric 5: | Currency | Medium | The study was conducted in June 2013 and June 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | One urine spot sample was collected at one timepoint from 796 participants without the use of replicates. 656 participants provided second samples one year later. |
| | Metric 7: | Exposure Scenario | Medium | The study is measuring phthalates in men with demographics given. However, the source of exposure is unclear. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data points are not reported; summary statistics include percentage of samples above LOD, mean, minimum, maximum, and percentiles (5, 25, 50, 75, 95) of concentration. |
| | Metric 9: | Quality Assurance | Medium | QA/QC techniques are not directly discussed except for reporting of recovery for each metabolite (between 81.6% and 105.5%). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The relative standard deviation for each metabolite was reported to be below 10%, indicating low variability. Limitation/sources of uncertainty are also briefly discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Yang, T. C., Peterson, K. E., Meeker, J. D., Sánchez, B. N., Zhang, Z., Cantoral, A., Solano, M., Tellez-Rojo, M. M. (2017). Bisphenol A and phthalates in utero and in childhood: association with child BMI z-score and adiposity. Environmental Research 156:326-333. |
| **HERO ID:** | 3859043 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Participant characteristics and urine sampling were described. |
| | Metric 2: | Analytical Methodology | Medium | Method details were mostly described elsewhere (Lewis et al., 2013; Calafat et al., 2008; Silva et al., 2007). The methods were modified based on an unspecified validated CDC method. |
| | Metric 3: | Biomarker Selection | High | MBzP is specific to BzBP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted in Mexico. |
| | Metric 5: | Currency | Medium | Samples were collected in 2012. |
| | Metric 6: | Spatial and Temporal Variability | Low | Authors collected 223 prenatal urine samples and 242 urine samples from children. Only a spot (second morning void) was collected. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study were exposure to children occurred in-utero. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics included geometric mean, SD, min, max, 25th, 50th, 75th percentiles. No raw data were provided. |
| | Metric 9: | Quality Assurance | Low | Specific-gravity was accounted for, but QA/QC techniques were mostly not discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Some limitations were reported toward the end of Discussion. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Sobolewski, M., Weiss, B., Martin, M., Gurven, M., Barrett, E. (2017). Toxicoanthropology: Phthalate exposure in relation to market access in a remote forager-horticulturalist population. International Journal of Hygiene and Environmental Health 220(5):799-809. |
| **HERO ID:** | 3859047 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Participants and sampling described, not much detail about urine sampling timing. |
| | Metric 2: | Analytical Methodology | Medium | Method briefly described with further details cited in Silva et al., 2007. LOD reported in Table 1. |
| | Metric 3: | Biomarker Selection | High | Metabolite in urine. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Bolivia |
| | Metric 5: | Currency | Medium | 2008-2009 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 59, no replicates, limited details about urine sampling timing. |
| | Metric 7: | Exposure Scenario | High | Biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | 25th, median, 75th. |
| | Metric 9: | Quality Assurance | Low | QA not discussed, no obvious concerns. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability and uncertainty including factors leading to metabolite variation and study limitations discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Sakhi, A. K., Sabaredzovic, A., Cequier, E., Thomsen, C. (2017). Phthalate metabolites in Norwegian mothers and children: Levels, diurnal variation and use of personal care products. Science of the Total Environment 599-600:1984-1992. |
| **HERO ID:** | 3859057 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Participants and sampling described. Approaches to avoid contamination reported. Urine samples from mother and child. Morning void urine sample and evening samples. A subset provided daily spot urine samples. |
| | Metric 2: | Analytical Methodology | Medium | Methods described else where (Sabaredzovic et al., 2015) and briefly described in text. LOD provided in S1. Reported using QA/QC, some is shown, nothing about calibration. |
| | Metric 3: | Biomarker Selection | High | metabolite in urine |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Norway |
| | Metric 5: | Currency | Medium | 2012 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 23 to 48 depending on timepoint, no replicates |
| | Metric 7: | Exposure Scenario | High | biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | median, min, max |
| | Metric 9: | Quality Assurance | Low | QA not discussed, no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Šidlovská, M., Petrovičová, I., Kolena, B., Pilka, T., Šovčíková, E., Trnovec, T. (2017). Exposure of children to phthalates and the impact of consumer practices in Slovakia. Reviews on Environmental Health 32(1-2):211-214. |
| **HERO ID:** | 3859080 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Participants and sampling described only briefly. Some information such as urine collection equipment and storage duration was missing. |
| | Metric 2: | Analytical Methodology | Low | Authors cited previously reported method by Pilka et al. LODs/LOQs were not provided. |
| | Metric 3: | Biomarker Selection | High | MiBP is specific to DiBP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Slovakia. |
| | Metric 5: | Currency | Low | Only a publication year of 2017 was provided. |
| | Metric 6: | Spatial and Temporal Variability | Low | The study consisted of 107 children. No sample replicates were collected, and authors reported only urine spot samples. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring where exposure occurs through the widespread use of phthalates. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data were provided. |
| | Metric 9: | Quality Assurance | Low | Authors did not discuss their QA/QC protocol. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Standard deviation was provided in Table 1. There was no discussion of limitations, gaps, or uncertainties. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | González-Mariño, I., Rodil, R., Barrio, I., Cela, R., Quintana, J. B. (2017). Wastewater-based epidemiology as a new tool for estimating population exposure to phthalate plasticizers. Environmental Science & Technology 51(7):3902-3910. |
| **HERO ID:** | 3859087 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported. Wastewater from various plants, collected by automatic samplers operating in time proportional mode |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported. Used liquid chromatography-tandem mass spectrometry (LC−MS/MS) for analysis of samples. Limits of quantification reported in text. |
| | Metric 3: | Biomarker Selection | High | Metabolites in wastewater, see table 1 for matching of metabolites to parent chemical. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Spain |
| | Metric 5: | Currency | High | Samples collected in 2015 and 2016 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Raw data reported |
| | Metric 9: | Quality Assurance | High | Analytical QA/QC reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Saeed, T., Al-Jandal, N., Abusam, A., Taqi, H., Al-Khabbaz, A., Zafar, J. (2017). Sources and levels of endocrine disrupting compounds (EDCs) in Kuwait's coastal areas. Marine Pollution Bulletin 118(1-2):407-412. |
| **HERO ID:** | 3859095 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Authors provided a detailed description of sampling sites, methodology (e.g., equipment, storage), and processing methods (mostly relevant to sediments). |
| | Metric 2: | Analytical Methodology | Low | Detection limits were not reported. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Kuwait. |
| | Metric 5: | Currency | High | Samples were collected during 2015-2016. |
| | Metric 6: | Spatial and Temporal Variability | Medium | A total of 41 samples (14, 12, 15) were collected without replicates from the inflow and outflow of three water treatment plants. Sediment and seawater were collected once from each of five different locations. No replicates were reported. |
| | Metric 7: | Exposure Scenario | High | Phthalates in seawater/coastal areas near sewage treatment is relevant |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data provided for phthalates levels at the 3 treatment plants in Tables S2-S4. Tables 3-4 show raw data for seawater and marine samples. Summary statistics were missing though. |
| | Metric 9: | Quality Assurance | Medium | Authors reported that about 10% of samples were duplicated, and recovery standards were incorporated. Recoveries were reported in Table S1 and acceptable. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No measures of variance were provided, but raw data were available. There was no discussion about limitations. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Chi, C., Xia, M., Zhou, C., Wang, X., Weng, M., Shen, X. (2017). Determination of 15 phthalate esters in air by gas-phase and particle-phase simultaneous sampling. Journal of Environmental Sciences 55:137-145. |
| **HERO ID:** | 3859102 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling method, equipment, and conditions were described. |
| | Metric 2: | Analytical Methodology | High | GCMS was used to perform the analysis. MDL and IDL were reported for each chemical for 2 phases - gas and particle. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study only reported that 4 different kinds of microenvironments were collected, but no specific locations were reported. |
| | Metric 5: | Currency | Low | No sampling date or publication date is provided - 2016. |
| | Metric 6: | Spatial and Temporal Variability | High | The number of air samples collected from busses, subways, taxis and private cars was 105, 40, 30, 60, respectively. |
| | Metric 7: | Exposure Scenario | High | Exposure matrix was relevant - indoor air from different kinds of traffic microenvironments. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Mean concentrations were reported with range, no individual data were reported. |
| | Metric 9: | Quality Assurance | High | QA/QC was performed, recovery rate were all above 90%. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | The study had a robust discussion of variability and the sampling methods. |

## Overall Quality Determination High

**Study Citation:** Mailler, R., Gasperi, J., Patureau, D., Vulliet, E., Delgenes, N., Danel, A., Deshayes, S., Eudes, V., Guerin, S., Moilleron, R., Chebbo, G., Rocher, V. (2017). Fate of emerging and priority micropollutants during the sewage sludge treatment: Case study of Paris conurbation. Part 1: Contamination of the different types of sewage sludge. Waste Management 59:379-393.

**HERO ID:** 3859167

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | sludge from three sludge treatment plants; characteristics of each plant and waste/treatment type provided in Table S1 and S2; each sludge type (raw sludge (RS), centrifuged sludge (CS), digested sludge (DS), thermally dried sludge (TS) and sludge cake (SC), centrifuged (CW) and condensed water (TDW)) sampled 6 times at inlet and outlet; sampling equipment, strategy, and storage not discussed |
| | Metric 2: | Analytical Methodology | High | Tables S3, S4, and 1 provide extraction, analytical standard, recoveries; LOQ |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Paris, France |
| | Metric 5: | Currency | Medium | Apr-14 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n=3-7 campaigns; 3 plants; only monitored in April 2014 |
| | Metric 7: | Exposure Scenario | High | concentration in different kinds of sludge (raw, centrifuged, digested, thermally dried sludge and sludge cake); untreated and treated; also concentration in sludge liquors |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | discussed Section 3.2.5, Fig 3, Table 4; Table S7 provides mean, std, and range per sludge type |
| | Metric 9: | Quality Assurance | Medium | Table S3 provides recoveries (80%); no further discussion of QA/QC |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | compares concentration between sludge type and between the different compounds; also compares to previously published papers |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Li, R., Liang, J., Duan, H., Gong, Z. (2017). Spatial distribution and seasonal variation of phthalate esters in the Jiulong River estuary, Southeast China. Marine Pollution Bulletin 122(1-2):38-46. |
| **HERO ID:** | 3859571 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Samples were collected from 15 sites along the salinity gradient in the river estuary during Aug, April, and January (Fig 1). Water samples were collected from the top layer (0-20cm) in 10L stainless steel barrel and filtered to separate SPM from water and stored at 4C. SPM was free-dried. The top 0-10cm of sediment was collected with grab sampler, stored in glass jar at 4C, freeze-dried at -20C for 72 hours, ground, and sieved. Plastic equipment was avoided to minimize contamination. |
| | Metric 2: | Analytical Methodology | Medium | Methods used included SPE and GC-MS. Recoveries were reported, but only ranges were provided (pg 40) for LOQs. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in various environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected from the Jiulong River estuary, Fujian, Southeast China. |
| | Metric 5: | Currency | High | Samples were collected in April and August (2014) and January (2015). |
| | Metric 6: | Spatial and Temporal Variability | Medium | 15 sites were sampled in normal (April), wet (August), and dry (January) seasons. Each site was sampled once person season without replicates. |
| | Metric 7: | Exposure Scenario | High | Study measured phthalate concentrations in river water, suspended particulate matter, and sediment of an estuary affected by river runoff, sewage discharge, agriculture, tourist industry and shipping. The spatial distribution and seasonal variations were also evaluated. This scenario is relevant to local communities who use the estuary. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | N/A | BBP not quantified in water, SPM, and sediment samples. |
| | Metric 9: | Quality Assurance | High | The range of recoveries was provided on p. 40 (section 2.4) were acceptable. Authors also reported analyzing sample duplicate, procedural blank, and spiked blank. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variance was characterized with range but only minimal discussion of limitations and uncertainties. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Subedi, B., Sullivan, K. D., Dhungana, B. (2017). Phthalate and non-phthalate plasticizers in indoor dust from childcare facilities, salons, and homes across the USA. Environmental Pollution 230:701-708. |
| **HERO ID:** | 3860935 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methods, materials, location, time and storage conditions reported. |
| | Metric 2: | Analytical Methodology | Medium | Analytical methods, instrument and LOD reported as a range. |
| | Metric 3: | Biomarker Selection | N/A | Concentrations reported in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples taken from South Dakota, Ohio, Indiana, Kentucky, Texas, Maryland, California and Massachusetts. |
| | Metric 5: | Currency | High | Samples taken in 2016. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 12 childcare facility samples, 5 salon samples, 11 home samples taken. No replicates were taken. |
| | Metric 7: | Exposure Scenario | High | The study represents indoor air exposure for the general population. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual points reported. Summary stats not reported. |
| | Metric 9: | Quality Assurance | High | QA/QC reported in detail. Recoveries over 100% reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | No gaps nor limitations reported. Variability accounted for in different settings sampled. |

## Overall Quality Determination High

**Study Citation:** Le Coadou, L., Le Ménach, K., Labadie, P., Dévier, M. H., Pardon, P., Augagneur, S., Budzinski, H. (2017). Quality survey of natural mineral water and spring water sold in France: Monitoring of hormones, pharmaceuticals, pesticides, perfluoroalkyl substances, phthalates, and alkylphenols at the ultra-trace level. Science of the Total Environment 603-604:651-662.

**HERO ID:** 3864659

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling equipment and methods are described in sufficient detail, but certain aspects (e.g. duration of storage) were absent that are unlikely to have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | High | Analytical instrumentation and methods are described in sufficient detail and are scientifically sound. LOQ is reported for each analyte in Table S1. |
| | Metric 3: | Biomarker Selection | N/A | This study is testing for the parent chemical of interest in an environmental medium. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected for bottled water sold in France, but the actual source of the water were located in France, New Caledonia, Reunion Island, Luxembourg, and Italy. |
| | Metric 5: | Currency | Medium | Samples were collected in 2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 40 brands of bottled water were sampled without replicates. |
| | Metric 7: | Exposure Scenario | High | Samples were collected directly after the bottling process and are a good representation of exposure to the consumer. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | N/A | All results for phthalates were below the limit of quantification. Therefore, there were no data to report or summarize statistically. |
| | Metric 9: | Quality Assurance | High | QA/QC measures included the use of blanks, control samples, internal standards, and external calibration (in order to prevent internal phthalates contamination) in procedures documented by other references. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Because all samples were below LOQ, no characterization of variability could be reported. A robust discussion demonstrated minimal uncertainties from the analytical process. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Messerlian, C., Bellinger, D., Mínguez-Alarcón, L., Romano, M. E., Ford, J. B., Williams, P. L., Calafat, A. M., Hauser, R., Braun, J. M. (2017). Paternal and maternal preconception urinary phthalate metabolite concentrations and child behavior. Environmental Research 158:720-728. |
| **HERO ID:** | 3972244 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Pertinent sampling methods (e.g., participants characteristics, sampling periods, equipment, and storage) were described. |
| | Metric 2: | Analytical Methodology | Medium | Analytical method identified as solid phase extraction-high performance liquid chromatography-isotope dilution tandem mass spectrometry with a reference to Silva et al., 2007. No further details were provided. LOD provided in SI. |
| | Metric 3: | Biomarker Selection | High | MBzP is specific to BBzP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Participants were from the US. |
| | Metric 5: | Currency | Low | It is unclear when urine samples were taken from mothers and fathers, but could have started as early as 2004 and lasted through 2015. Scoring low because of the uncertainty and wide time period for sample collection. |
| | Metric 6: | Spatial and Temporal Variability | Low | More than 100 samples were collected at different points in preconception among women and men. There was no report of replicates. Multiple spot urine samples were collected, and it is unclear if they were pooled or not (likely not). |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 1A of SI provides detection frequency, GM, GSD, median, and IQR. Raw data were not provided. |
| | Metric 9: | Quality Assurance | Medium | Urine dilution was accounted with specific gravity. However, little else QA/QC methods were described. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variance characterized with geometric standard deviation and IQR. Limitations described in Discussion. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Huang, Y. F., Pan, W. C., Tsai, Y. A., Chang, C. H., Chen, P. J., Shao, Y. S., Tsai, M. S., Hou, J. W., Lu, C. A., Chen, M. L. (2017). Concurrent exposures to nonylphenol, bisphenol A, phthalates, and organophosphate pesticides on birth outcomes: A cohort study in Taipei, Taiwan. Science of the Total Environment 607-608:1126-1135. |
| **HERO ID:** | 3972262 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods (e.g., participant characteristics, equipment, storage) were reported. |
| | Metric 2: | Analytical Methodology | Medium | Extraction and analytical methods were reported, as well as LODs and recoveries. However, analytical methods were brief as only a reference was provided. |
| | Metric 3: | Biomarker Selection | High | MBzP is specific to BzBP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Participants were in Taiwan. |
| | Metric 5: | Currency | Medium | Samples collected in 2010. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 162 women provided three spot urine samples with no replicates, but only 112 of them were analyzed for phthalates due to small sample volume. Urine samples were pooled. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study where widespread exposure occurs through use of a variety of products, etc |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. |
| | Metric 9: | Quality Assurance | High | QA/QC methods were reported (e.g., blank and spiked samples, recoveries which were acceptable, creatinine analysis). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Some gaps and limitations were reported at the end of Discussion. Variance characterized with range. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Watkins, D. J., Sánchez, B. N., Téllez-Rojo, M. M., Lee, J. M., Mercado-García, A., Blank-Goldenberg, C., Peterson, K. E., Meeker, J. D. (2017). Impact of phthalate and BPA exposure during in utero windows of susceptibility on reproductive hormones and sexual maturation in peripubertal males. Environmental Health 16(1):69. |
| **HERO ID:** | 3972348 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | participant information and sampling summary provided. Measures to avoid sampling phthalate contamination missing |
| | Metric 2: | Analytical Methodology | Medium | LOD provided; analysis conducted at NSF International. Missing QA/QC. |
| | Metric 3: | Biomarker Selection | High | metabolite in urine |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Mexico |
| | Metric 5: | Currency | Low | 1997 to 2004 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 199 to 229 depending on visit, no replicates, urine morning void |
| | Metric 7: | Exposure Scenario | High | Biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | GM, GSD, max provided |
| | Metric 9: | Quality Assurance | Low | QA not discussed, no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Gaspéri, J., Ayrault, S., Moreau-Guigon, E., Alliot, F., Labadie, P., Budzinski, H., Blanchard, M., Muresan, B., Caupos, E., Cladière, M., Gateuille, D., Tassin, B., Bordier, L., Teil, M. J., Bourges, C., Desportes, A., Chevreuil, M., Moilleron, R. (2016). Contamination of soils by metals and organic micropollutants: case study of the Parisian conurbation. Environmental Science and Pollution Research 25(24):23559-23573. |
| **HERO ID:** | 3985396 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | 32 soil samples (fig 1) using a auger to collect first 10cm; each sample pooled three different cores collected 5 m from one another; homogenized and bagged; stored in dark; freeze-dried, ground, and stored at 4C |
| | Metric 2: | Analytical Methodology | Medium | extraction method not discussed; GC-MS; LOQ provided in Table S2; recovery samples not discussed |
| | Metric 3: | Biomarker Selection | N/A | soil samples |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Greater Paris, France |
| | Metric 5: | Currency | Medium | 2009-2010 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 32 samples (rural = 12; urban=20) sampled over a year; no replicates |
| | Metric 7: | Exposure Scenario | High | levels in soil from rural and densely urbanized areas |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | briefly discussed in text (range) p.23565 also depicted in Fig 4 (mean and SD); no indication results in SI |
| | Metric 9: | Quality Assurance | Low | states ”analyzed according to validated methods” |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | compares results to previous studies and around the world |

## Overall Quality Determination Medium

**Study Citation:** Muenhor, D., Moon, H. B., Lee, S., Goosey, E. (2018). Organophosphorus flame retardants (PFRs) and phthalates in floor and road dust from a manual e-waste dismantling facility and adjacent communities in Thailand. Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 53(1):79-90.

**HERO ID:** 4164912

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Referenced a previously described standardized protocol for their sampling methodology and included a summary of pertinent information. |
| | Metric 2: | Analytical Methodology | Medium | Analytical method discussed and LOQ provided. However, instrument calibration not discussed. |
| | Metric 3: | Biomarker Selection | N/A | Study tested the parent chemicals in floor and road dust. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected in Thailand. |
| | Metric 5: | Currency | Medium | Data collected in May 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 5-10 samples collected per microenvironment and no replicate data. |
| | Metric 7: | Exposure Scenario | High | Study examined exposure to floor and road dust from a manual e-waste dismantling facility and impact to nearby communities. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics presented such as mean and range. However, raw data not provided. |
| | Metric 9: | Quality Assurance | High | Pertinent QA/QC info provided, including recoveries and references to previously established protocols. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No discussion of limitations, data gaps, or uncertainties. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Celeiro, M., Dagnac, T., Llompart, M. (2017). Determination of priority and other hazardous substances in football fields of synthetic turf by gas chromatography-mass spectrometry: A health and environmental concern. Chemosphere 195:201-211. |
| **HERO ID:** | 4166969 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Detailed and clear sampling methodology |
| | Metric 2: | Analytical Methodology | Medium | Limited details about recoveries, reported LOD |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Spain |
| | Metric 5: | Currency | Medium | published in 2018, but sites were built after 2009 and replenished in the sampled materials periodically. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 15 samples, no replicates |
| | Metric 7: | Exposure Scenario | High | Data are likely to represent a relevant exposure scenario |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | individual sample concentrations and summary statistics reported |
| | Metric 9: | Quality Assurance | Medium | Limited information on recoveries, field and laboratory controls were analyzed |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Key uncertainties and limitations are not discussed |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Quintana-Belmares, R. O., Krais, A. M., Esfahani, B. K., Rosas-Pérez, I., Mucs, D., López-Marure, R., Bergman, Å., Alfaro-Moreno, E. (2018). Phthalate esters on urban airborne particles: Levels in PM10 and PM2.5 from Mexico City and theoretical assessment of lung exposure. Environmental Research 161:439-445. |
| **HERO ID:** | 4167514 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Detailed sampling methodology description, scientifically sound. |
| | Metric 2: | Analytical Methodology | Medium | Analytical methodology is briefly discussed, recovery samples or calibrations are not mentioned. LOD is discussed but not reported. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Mexico City. |
| | Metric 5: | Currency | Medium | Samples from 2013. |
| | Metric 6: | Spatial and Temporal Variability | High | Paper reports weekly sampling for 7 months, but number of samples is not reported explicitly. They "recovered 30 filters". |
| | Metric 7: | Exposure Scenario | High | Data closely represents a relevant exposure scenario for the population of Mexico City described in the manuscript. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual sample concentrations are not reported, only summary statistics. |
| | Metric 9: | Quality Assurance | Low | Field and laboratory blanks were not analyzed, recoveries were not reported. and QA/QC was not discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Key uncertainties and limitations are nor discussed, potentially having a substantial impact on the exposure assessment. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Lin, L. Y.,u, Tsai, M. S., Chen, M., Ng, S., Hsieh, C. J., Lin, C. C., Lu, F. L., Hsieh, W.,uS, Chen, P. (2018). Childhood exposure to phthalates and pulmonary function. Science of the Total Environment 615:1282-1289. |
| **HERO ID:** | 4170166 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Details of the sample process were reported in our previous studies (Wang et al., 2014; Weng et al., 2017) and not explained in this one. |
| | Metric 2: | Analytical Methodology | Medium | Citation to detailed methods was provided (Silva et al., 2004) and briefly described. LODs were provided in text. |
| | Metric 3: | Biomarker Selection | High | MBzP is specific to BBzP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Taiwan. |
| | Metric 5: | Currency | Medium | Samples were collected between 2004 and 2005. |
| | Metric 6: | Spatial and Temporal Variability | Low | The total number of samples ranged from 132-191 depending on age group. No replicates were reported. The urine sample type (e.g., pooled, spot) was not described. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Figure 1 has geometric mean and error bars that would need to be digitized. No raw data were provided. |
| | Metric 9: | Quality Assurance | Medium | Some QA/QC was not discussed, such as recoveries (acceptable), creatinine measurements, and analysis in duplicate and triplicate. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variance only visually shown with error bars. Uncertainty/limitations was not discussed. |
| **Overall Quality Determination** | | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | Wang, H., Liang, H., Gao, D. W. (2017). Occurrence and distribution of phthalate esters (PAEs) in wetland sediments. Journal of Forestry Research 28(6):1241-1248. |
| **HERO ID:** | 4172527 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling of sediments, materials used, and sample storage described. |
| | Metric 2: | Analytical Methodology | High | Sample extraction and analysis provided, used GC/MS. Analysis parameters and conditions reported. QA/QC described and adequate. Detection limits in text. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | Samples collected in 2014 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure scenario not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | raw data not reported |
| | Metric 9: | Quality Assurance | High | Key QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability among sites discussed. Sources of uncertainty were discussed and appropriate. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Wang, L., Gong, M., Xu, Y., Zhang, Y. (2017). Phthalates in dust collected from various indoor environments in Beijing, China and resulting non-dietary human exposure. Building and Environment 124(Elsevier):315-322. |
| **HERO ID:** | 4176702 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology is thoroughly described and scientifically sound. No key details are omitted. |
| | Metric 2: | Analytical Methodology | Low | The analytical methodology is described; however, the limit of detection is mentioned but the value of the limit is not provided. |
| | Metric 3: | Biomarker Selection | N/A | Study is testing for parent chemical in house dust. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Beijing. |
| | Metric 5: | Currency | Medium | Samples were collected from 2010 to 2011. |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicate samples collected |
| | Metric 7: | Exposure Scenario | High | Exposure scenario is concentration in dust in houses, which is a scenario of interest. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data is not provided, but summary statistics are provided. |
| | Metric 9: | Quality Assurance | High | QA/QC methods are provided and no issues were identified. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability and uncertainty are characterized and discussed. Ranges are given for measurements. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Olofsson, U., Brorström-Lundén, E., Kylin, H., Haglund, P. (2013). Comprehensive mass flow analysis of Swedish sludge contaminants. Chemosphere 90(1):28-35. |
| **HERO ID:** | 4182871 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | The sampling methodology is discussed in the supplement. The discussion contains most information (site characters, sampling procedure, storage). |
| | Metric 2: | Analytical Methodology | Medium | Analytical procedure was performed by other labs. LOD was mentioned to be calculated but not reported in the document. |
| | Metric 3: | Biomarker Selection | N/A | The study tested in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in Sweden. |
| | Metric 5: | Currency | Low | The study took place in Autumn of 2004. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Sludge samples were collected at seven STPs. |
| | Metric 7: | Exposure Scenario | Medium | Sludge was reported as the exposure medium. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | The supplement contained the individual data points but still lacked a few important information including standard deviation. |
| | Metric 9: | Quality Assurance | High | Quality assurance and quality checks was discussed in the supplement. No issues were identified. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study has limited discussion of key uncertainties, limitations, and data gaps. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Olesen, T. S., Bleses, D., Andersen, H. R., Grandjean, P., Frederiksen, H., Trecca, F., Bilenberg, N., Kyhl, H. B., Dalsager, L., Jensen, I. K., Andersson, A. M., Jensen, T. K. (2017). Prenatal phthalate exposure and language development in toddlers from the Odense Child Cohort. Neurotoxicology and Teratology 65:34-41. |
| **HERO ID:** | 4198566 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most pertinent sampling information is provided in the data source or companion source, including sample storage condition and population characteristics, but lacking sampling equipment and specific sampling procedures/regime, performance/calibration of sampler. |
| | Metric 2: | Analytical Methodology | High | Analytical techniques were reported (LC-MS/MS) and LOD were reported for each metabolite (see supplemental table S1). |
| | Metric 3: | Biomarker Selection | High | Biomarker (parent chemical or metabolite) is derived from exposure to the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Odense, Denmark |
| | Metric 5: | Currency | Medium | 2010-2012 |
| | Metric 6: | Spatial and Temporal Variability | High | Urinary samples from 518 pregnant women were reported. |
| | Metric 7: | Exposure Scenario | Medium | The data likely represent the relevant exposure scenario of children. Study does not have detailed information on source of exposure. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics reported. Raw data not given. |
| | Metric 9: | Quality Assurance | Medium | The study applied and documented quality assurance/quality control measures and described the completeness of samples including measuring osmolality; however, one piece of QA/QC information, recoveries, is not described. Missing information is unlikely to have a substantial impact on results. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Key uncertainties, limitations, and data gaps have been identified. Study also compared with other studies (see supplemental). |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | ERM-Northeast, (1992). ECRA sampling and analysis plan report - AlliedSignal Aerospace Company Bendix Electric Power Division with cover letter dated 111693. |
| **HERO ID:** | 4213973 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Critically Deficient | Sampling methodology was not described |
| | Metric 2: | Analytical Methodology | Critically Deficient | Analytical methodology was not discussed |
| | Metric 3: | Biomarker Selection | N/A | Not applicable |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | NJ, USA |
| | Metric 5: | Currency | Low | Published in 1992 |
| | Metric 6: | Spatial and Temporal Variability | Critically Deficient | Sample size was not reported |
| | Metric 7: | Exposure Scenario | Medium | Did not describe the population of interest |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only individual sample concentrations, no summary statistics |
| | Metric 9: | Quality Assurance | High | Analyzed control samples, described QA/QC techniques |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Limited description of uncertainties, no characterization of variability |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Allied Signal, (1990). Letter from Allied-Signal Inc notifying USEPA of their intentions to conduct an environmental assessment pursuant to the Environment Cleanup Responsibility Act with attachments. |
| **HERO ID:** | 4214323 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling and analytical plan are described across the document from 1983 (page 168) -1986 (page 455) |
| | Metric 2: | Analytical Methodology | Medium | Sampling and analytical plan are described across the document from 1983 (page 168) -1986 (page 455). LOD or LOQ reported in most of the data tables |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in ground water and soil samples |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Eatontown, New Jersey |
| | Metric 5: | Currency | Low | 1983-1986 |
| | Metric 6: | Spatial and Temporal Variability | Low | Sample size in total is not reported, but the report has sampling data from 1983-1986 |
| | Metric 7: | Exposure Scenario | High | Organic compounds contamination in ground water and solids from the Bendix- Electric Power Division facility |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Only individual data points, no summary of statistics |
| | Metric 9: | Quality Assurance | High | QA/QC reported for most of the sampling periods |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Sampling from 1983-1986, no report on key limitations |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Bizarro, C., Ros, O., Vallejo, A., Prieto, A., Etxebarria, N., Cajaraville, M. P., Ortiz-Zarragoitia, M. (2014). Intersex condition and molecular markers of endocrine disruption in relation with burdens of emerging pollutants in thicklip grey mullets (Chelon labrosus) from Basque estuaries (South-East Bay of Biscay). Marine Environmental Research 96:19-28. |
| **HERO ID:** | 4214525 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Section 2.1; surface water and fish samples (bile); surface water filtered |
| | Metric 2: | Analytical Methodology | High | LVI-PTV-GC-MS and GC-MS for surface water; GC-MS for fish bile; LOD and LOQ Tables 2 and 3 |
| | Metric 3: | Biomarker Selection | N/A | Transcription levels of cyp19a1b in the brain and vtg in the liver - our scope does not include biological responses |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | five estuaries of the Basque Coast in SE Bay of Biscay (Europe); Figure 1 |
| | Metric 5: | Currency | Medium | Jun-12 |
| | Metric 6: | Spatial and Temporal Variability | High | at each sampling site (5 estuaries) 12-20 adult male mullets collected; three water subsamples per sampling site |
| | Metric 7: | Exposure Scenario | High | 2 commercial port areas, one fishing port, one marina and downstream of sewage treatment plant |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Table 2 concentrations in surface water of each estuary; Table 3 mean and SD of bile analytes in male and intersex mullets; individual data not provided; no SI; no other statistics provided |
| | Metric 9: | Quality Assurance | Medium | recoveries were 66-129% and good repeatability (3-19%) for water samples; recoveries were 63-122% and good repeatability (1-24%) for fish bile |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | levels varied according to sampling sites |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Liang, J., Ning, X. A., Kong, M., Liu, D., Wang, G., Cai, H., Sun, J., Zhang, Y., Lu, X., Yuan, Y. (2017). Elimination and ecotoxicity evaluation of phthalic acid esters from textile-dyeing wastewater. Environmental Pollution 231(Pt 1):115-122. |
| **HERO ID:** | 4259743 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Methods, location, equipment and storage condition reported. |
| | Metric 2: | Analytical Methodology | Medium | Key analytical methods and instrument reported. Limit of detection reported as a range. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in China. |
| | Metric 5: | Currency | High | Sampling campaign conducted in 2017. |
| | Metric 6: | Spatial and Temporal Variability | Low | 4 plants sampled with no replicates. |
| | Metric 7: | Exposure Scenario | Medium | The samples are taken from wastewater effluent which is an applicable exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics reported. Raw data not reported. |
| | Metric 9: | Quality Assurance | High | QA procedures followed and all recoveries >70%. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | No gaps and limitations reported. Variability accounted for different plants sampled. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Liao, C., Liu, W., Zhang, J., Shi, W., Wang, X., Cai, J., Zou, Z., Lu, R., Sun, C., Wang, H., Huang, C., Zhao, Z. (2018). Associations of urinary phthalate metabolites with residential characteristics, lifestyles, and dietary habits among young children in Shanghai, China. Science of the Total Environment 616-617:1288-1297. |
| **HERO ID:** | 4285933 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Method selecting children presented in Huang et al. (2016) and Wang et al. (2016). First morning urine collected in polyethylene containers; stored -40 C. Questionnaires on residential characteristics, lifestyle (cleaning habits), foods, etc. (see Supplemental Table A.1). |
| | Metric 2: | Analytical Methodology | High | SPE; isotope dilution-HPLC-heated electrospray ionization source (HESI) with triple quadrupole MS. Sample preparation and measurement conditions thoroughly described. LOD and LOQ in appendix |
| | Metric 3: | Biomarker Selection | High | MBzP in first morning urine. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China, Shanghai, six districts |
| | Metric 5: | Currency | Medium | March 2013 to December 2014 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Children aged 5-10 years, n = 434. Comparison groups of 213 girls and 221 boys; suburban vs urban; low and high frequencies of cleaning/dusting/changing bedclothes; some food types. Minimum group size for comparison >10. However, only one urine sample per child. |
| | Metric 7: | Exposure Scenario | Medium | Evaluated many in-home possible exposure characteristics via questionnaire or in-home visit. Highest phthalate metabolites in urine during summer; five other associations identified. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Reported n, % detect, mean (and SD), geometric mean, 5th, 25th, 50th, 75th, and 95th percentiles. |
| | Metric 9: | Quality Assurance | High | Low and high-concentration QC (n=3 each) samples and 3 blanks per batch of 48 (or 96) samples; 7 internal standard concentration calibration levels; Supplemental Table A.4 reports QC details by metabolite. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Children sampled across all 4 seasons; however, only one first morning urine sample per child. Study limitations noted; compared results with those from 9 other countries (Figure 1). |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | He, M. J., Lu, J. F., Ma, J. Y., Wang, H., Du, X. F. (2018). Organophosphate esters and phthalate esters in human hair from rural and urban areas, Chongqing, China: Concentrations, composition profiles and sources in comparison to street dust. Environmental Pollution 237(Elsevier):143-153. |
| **HERO ID:** | 4574307 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology was detailed in terms of equipment, procedures, sample storage conditions, study site characteristics for hair and dust. Insufficient information was provided on sample storage duration prior to analysis. |
| | Metric 2: | Analytical Methodology | High | Analytical methodology was described in terms of extraction and recovery range and referenced in terms of analytical instrumentation details within previous study and SI. LOD/LOQ information was presented within SI. |
| | Metric 3: | Biomarker Selection | N/A | The analyte measured is the TSCA chemical. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Chongqing, China. |
| | Metric 5: | Currency | Medium | Sampling was conducted in 2014 for hair and dust. |
| | Metric 6: | Spatial and Temporal Variability | Medium | There was a large sample size for rural (n=154) and urban (n=43) hair samples, but single sampling for each participant and non-statistical sampling methods. There was a moderate sample size for rural (n=6) and urban (n=6) dust samples and authors note replicate (three sub-samples) sampling, but location of dust sampling within the residence was not described within text and non-statistical sampling methodology. |
| | Metric 7: | Exposure Scenario | High | Participant occupations noted as including government officers, salesmen, students and retired people in urban areas, with agricultural work as the primary occupation of rural participants. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics reported in terms of range, mean (SD), median, number of samples, urban/rural location and detection frequencies. Insufficient information was provided on raw data for individual participants. |
| | Metric 9: | Quality Assurance | High | Study QA/QC details within text included laboratory control/blanks, recoveries, and blank-correction of lab results with further information within SI. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Range of chemical-specific concentrations was reported, and results were compared with previous work. Potential sources of exposure for sampling media, and limitations in terms of the exogenous and endogenous source exposures for hair analysis due to unwashed hair sampling and limited sample size for dust sampling was discussed. Authors acknowledge lack of gender analysis due to limited number of female participants, but do not discuss this in relation to concentrations related to personal care products in this study, or other potential study limitations (e.g., possible data gaps). |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Okeme, J. O., Yang, C., Abdollahi, A., Dhal, S., Harris, S. A., Jantunen, L. M., Tsirlin, D., Diamond, M. L. (2018). Passive air sampling of flame retardants and plasticizers in Canadian homes using PDMS, XAD-coated PDMS and PUF samplers. Environmental Pollution 239:109-117. |
| **HERO ID:** | 4659643 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The study reports home air sampling and sample storage. |
| | Metric 2: | Analytical Methodology | Low | The analytical procedures were outlined. Section 2.5 discusses how LOD and LOQ calculated but no values provided. |
| | Metric 3: | Biomarker Selection | N/A | The parent chemical was measured in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in greater Toronto area and Ottawa, Canada. |
| | Metric 5: | Currency | High | Samples were collected in February and August 2015. |
| | Metric 6: | Spatial and Temporal Variability | High | Samples were collected in 32 homes in the Toronto area and 19 in Ottawa (homes included apartments, detached homes, semi-detached homes, townhouses and condos); sampled for 3 weeks; duplicate and field blanks were collected. |
| | Metric 7: | Exposure Scenario | Medium | The study focused on home sampling; 5 apartments, 34 detached homes, 7 semi-detached; 3 townhouses and 2 condos; number of residents ranged from 1 to 7. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data is not reported. Section 3.3 reported concentrations (min, max, median, mean, SD) and DF provided in Table S3d. |
| | Metric 9: | Quality Assurance | Medium | QA/QC reported in Section 2.5; recovery was corrected for individual compounds. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limitations are not reported, variability reported as SD, and comparison between other studies. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Zhu, Z. Y., Ji, Y. Q., Zhang, S. J., Zhao, J. B., Zhao, J. (2016). Phthalate Ester Concentrations, Sources, and Risks in the Ambient Air of Tianjin, China. Aerosol and Air Quality Research 16(9):2294-2301. |
| **HERO ID:** | 4727284 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling equipment and methods are described in sufficient detail, but certain aspects (e.g. duration of storage) were absent that are unlikely to have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | High | Analytical instrumentation and methods are described in good detail and are scientifically sound. LOD is reported for each analyte. |
| | Metric 3: | Biomarker Selection | N/A | This study is testing for the parent chemical in an environmental medium. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Tianjin, China |
| | Metric 5: | Currency | Medium | 2014 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 24h particulate matter samples from four sites for eight days each, but no replicates. |
| | Metric 7: | Exposure Scenario | Medium | Sampling sites are only characterized by geographical location and by an ”urban” label. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data are not reported; summary statistics include mean, standard deviation, median, minimum, and maximum concentration for each particulate filtrate size in each season. |
| | Metric 9: | Quality Assurance | High | QA/QC measures included the use of internal standard and spiked blanks to determine calibration linearity and recovery, which were both reported to be in acceptable ranges. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Characterization of variability is reported, but discussion of pertinent study limitations or sources of uncertainty is absent. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Rahbar, M. H., Swingle, H. M., Christian, M. A., Hessabi, M., Lee, M., Pitcher, M. R., Campbell, S., Mitchell, A., Krone, R., Loveland, K. A., Patterson, D. G. (2017). Environmental Exposure to Dioxins, Dibenzofurans, Bisphenol A, and Phthalates in Children with and without Autism Spectrum Disorder Living near the Gulf of Mexico. |
| **HERO ID:** | 4728376 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | participants and sampling described briefly |
| | Metric 2: | Analytical Methodology | Medium | LOD range provided, analysis performed by LabCorp Laboratory using standard methods approved by CALA and NELAP. |
| | Metric 3: | Biomarker Selection | High | metabolite in urine |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | U.S. |
| | Metric 5: | Currency | High | 2015-2016 |
| | Metric 6: | Spatial and Temporal Variability | Low | n = 40, no replicates, urine sampling details not provided |
| | Metric 7: | Exposure Scenario | Low | biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Mean, SD, range provided |
| | Metric 9: | Quality Assurance | Low | QA not discussed, no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Salaudeen, T., Okoh, O., Agunbiade, F., Okoh, A. (2018). Fate and impact of phthalates in activated sludge treated municipal wastewater on the water bodies in the Eastern Cape, South Africa. Chemosphere 203(Elsevier):336-344. |
| **HERO ID:** | 4728386 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Detailed and scientifically sound sampling methodology |
| | Metric 2: | Analytical Methodology | High | Detailed analytical methodology, included LODs, LOQ, calibrations, recoveries |
| | Metric 3: | Biomarker Selection | N/A | Sludge sampling |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | South Africa |
| | Metric 5: | Currency | High | 2016 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Daily sampling for 6 months at 3 sampling points. No replicate samples. |
| | Metric 7: | Exposure Scenario | Medium | Data are likely to represent a relevant exposure scenario |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual concentration data not provided, only summary statistics |
| | Metric 9: | Quality Assurance | High | Analyzed control samples, reported recoveries, detailed QA/QC section |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited discussion of variability, uncertainties and study limitations |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Minatoya, M., Araki, A., Miyashita, C., Ait Bamai, Y., Itoh, S., Yamamoto, J., Onoda, Y., Ogasawara, K., Matsumura, T., Kishi, R. (2018). Association between prenatal bisphenol A and phthalate exposures and fetal metabolic related biomarkers: The Hokkaido study on Environment and Children's Health. Environmental Research 161:505-511. |
| **HERO ID:** | 4728391 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methods, participant information and sample storage all reported. |
| | Metric 2: | Analytical Methodology | High | Analytical methods, instrument, calibration and LOD reported. |
| | Metric 3: | Biomarker Selection | High | Biomarker is known to be related with external exposure. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in Japan. |
| | Metric 5: | Currency | Low | Sampling from 2003-2012. |
| | Metric 6: | Spatial and Temporal Variability | Low | 365 samples with no replicates. |
| | Metric 7: | Exposure Scenario | High | Data represents exposure scenarios of pregnant women. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics reported. No raw data reported. |
| | Metric 9: | Quality Assurance | High | QA/QC techniques discussed in supplemental, including recoveries >70%. Limitations also reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Characterized variability and discussed uncertainties and limitations |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Polinski, K. J., Dabelea, D., Hamman, R. F., Adgate, J. L., Calafat, A. M., Ye, X., Starling, A. P. (2018). Distribution and predictors of urinary concentrations of phthalate metabolites and phenols among pregnant women in the Healthy Start Study. Environmental Research 162:308-317. |
| **HERO ID:** | 4728411 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most key criteria met. Duration of sample storage data lacking. |
| | Metric 2: | Analytical Methodology | Medium | Most key criteria met, chemical-specific LOD's reported within supplemental material, lack of recovery sample data. |
| | Metric 3: | Biomarker Selection | High | Supplemental Table 1 contains specific metabolite concentrations. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples provided by participants in the state of Colorado. |
| | Metric 5: | Currency | High | Samples collected 2009-2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Total of n=446 participants in convenience (non-statistical sampling approach) sample, providing single spot urines at 24-32 weeks gestation. Additional sub-sample of women (n=24) had three spot urine samples collected at two-week intervals. |
| | Metric 7: | Exposure Scenario | Medium | Participant characteristics summarized, lack of information on pre-exposure or control samples. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Most key criteria met; lack of raw data. |
| | Metric 9: | Quality Assurance | Low | Quality assurance procedures not described, however laboratory methods referenced. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability characterized within summary statistics, potential study limitations discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Li, X., Sun, H., Yao, Y., Zhao, Z., Qin, X., Duan, Y., Wang, L. (2018). Distribution of phthalate metabolites between paired maternal-fetal samples. Environmental Science & Technology 52(11):6626-6635. |
| **HERO ID:** | 4728430 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Participants described. Sample collection not described. |
| | Metric 2: | Analytical Methodology | Medium | Sample preparation described in SI. Mass spec described. Method detection limit in SI |
| | Metric 3: | Biomarker Selection | High | metabolite in urine |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | High | 2015 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 80 to 83 depending on sample type, no replicates, no details about urine sample collection |
| | Metric 7: | Exposure Scenario | High | biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | detection rate, mean, median, GM, and range provided. No raw data. |
| | Metric 9: | Quality Assurance | High | Blanks, spikes, and calibration described. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed, no obvious concerns |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Li, Y., Wang, J., Ren, B., Wang, H., Qiao, L., Zhu, J., Li, L. (2018). The characteristics of atmospheric phthalates in Shanghai: A haze case study and human exposure assessment. Atmospheric Environment 178:80-86. |
| **HERO ID:** | 4728440 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling equipment and methods are described. Sampling time and handling of tubes after sample collection are not evident. |
| | Metric 2: | Analytical Methodology | High | Analytical instrumentation and methods are described in sufficient detail and are scientifically sound. Instrument detection limit is reported for each analyte. |
| | Metric 3: | Biomarker Selection | N/A | This study is testing for the parent chemical of interest in an environmental medium. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | High | 2016 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Air samples were collected from one site over the course of 10 days. No replicates. |
| | Metric 7: | Exposure Scenario | High | The air sampling site is well characterized by its building types, traffic routes, and possible nearby pollution sources (none). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Raw data are not reported and there are some inconsistencies in the results resulting in low confidence. The number of samples or their relative size (duration of air sampling) are unclear based on the reporting of results, and individual phthalate concentrations are only reported numerically as a mean and range over all meteorological conditions; stratified analyses are only reported graphically. |
| | Metric 9: | Quality Assurance | High | QA/QC methods included the use of spiked replicates and blanks for determination of instrument detection limits, relative standard deviation, background contamination, desorption recovery, and linear range calibration. All results were in acceptable limits and corrections were made for minor issues when warranted (background contamination). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Characterization of variability is absent and key uncertainties and limitations are not discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Machtinger, R., Zhong, J., Mansur, A., Adir, M., Racowsky, C., Hauser, R., Brennan, K., Karlsson, O., Baccarelli, A. A. (2018). Placental lncRNA Expression Is Associated With Prenatal Phthalate Exposure. Toxicological Sciences 163(1):116-122. |
| **HERO ID:** | 4728442 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Participants and sampling described. |
| | Metric 2: | Analytical Methodology | Medium | LOD provided, CDC performed analyses. |
| | Metric 3: | Biomarker Selection | High | Metabolite in urine. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Israel |
| | Metric 5: | Currency | High | 2015 |
| | Metric 6: | Spatial and Temporal Variability | Low | n = 10, no replicates, urine samples not pooled. |
| | Metric 7: | Exposure Scenario | High | Biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | % below LOD, mean, median, max provided. |
| | Metric 9: | Quality Assurance | Medium | Standard quality assurance/quality control procedures discussed in detail before (Silva et al., 2013, 2017). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and uncertainty not discussed, no obvious concerns. |

## Overall Quality Determination Medium

**Study Citation:** Machtinger, R., Berman, T., Adir, M., Mansur, A., Baccarelli, A. A., Racowsky, C., Calafat, A. M., Hauser, R., Nahum, R. (2018). Urinary concentrations of phthalate metabolites, bisphenols and personal care product chemical biomarkers in pregnant women in Israel. Environment International 116(Elsevier):319-325.

**HERO ID:** 4728447

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported. |
| | Metric 2: | Analytical Methodology | Medium | Some analytical methods not reported such as recovery samples. |
| | Metric 3: | Biomarker Selection | High | Acceptable biomarker. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Israel. |
| | Metric 5: | Currency | High | Samples collected in 2015 and 2016. |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates. |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported. |
| | Metric 9: | Quality Assurance | Medium | QC referenced. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Some limitations reported. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Kishi, R., Ketema, R. M., Bamai, Y. A., Araki, A., Kawai, T., Tsuboi, T., Saito, I., Yoshioka, E., Saito, T. (2018). Indoor environmental pollutants and their association with sick house syndrome among adults and children in elementary school. Building and Environment 136:293-301. |
| **HERO ID:** | 4728476 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The sampling methodology is discussed, scientifically sound and consistent with widely accepted methods/approaches for the chemical and media being analyzed. The references for the full sampling description are provided. |
| | Metric 2: | Analytical Methodology | High | Analytical methodology is described, including analytical instrumentation and scientifically appropriate for the chemical and media analyzed. LOD is reported. The previous studies are referred for analysis method. |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in Sapporo, Japan. |
| | Metric 5: | Currency | Medium | The samples were collected in October and November of 2009 and 2010. |
| | Metric 6: | Spatial and Temporal Variability | High | There were 128 samples and no replicates. |
| | Metric 7: | Exposure Scenario | High | Indoor air exposures were measured in the residential house. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Full Raw data are not reported. Summary statistics were reported. |
| | Metric 9: | Quality Assurance | High | Quality assurance procedures in sample collection and analysis were reported with most key criteria met. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limitations are well described but variability and uncertainty are not well discussed. |

## Overall Quality Determination High

**Study Citation:** Kim, S., Eom, S., Kim, H. J., Lee, J. J., Choi, G., Choi, S., Kim, S., Kim, S. Y., Cho, G., Kim, Y. D., Suh, E., Kim, S. K., Kim, S., Kim, G. H., Moon, H. B., Park, J., Kim, S., Choi, K., Eun, S. H. (2018). Association between maternal exposure to major phthalates, heavy metals, and persistent organic pollutants, and the neurodevelopmental performances of their children at 1 to 2 years of age{\textendash}CHECK cohort study. Science of the Total Environment 624:377-384.

**HERO ID:** 4728479

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | The description of sampling methodology is limited. Authors cite previously peer-reviewed publications for more details. |
| | Metric 2: | Analytical Methodology | Low | Analytical methodology not described. Authors cite previously peer-reviewed publications for more details. Detection limits provided in footnote of Table 2 and matrix-adjustment creatinine adjustment reported. |
| | Metric 3: | Biomarker Selection | High | Sampling for metabolites in urine and breast milk specific for parent chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples provided by participants recruited from Seoul, Anyang, Ansan, and Jeju, Republic of Korea. |
| | Metric 5: | Currency | Low | Sample collection dates not reported, but study publication date is 2018. |
| | Metric 6: | Spatial and Temporal Variability | Medium | There were 86 maternal urine samples and 73 breast milk samples. Replicate samples not indicated. |
| | Metric 7: | Exposure Scenario | Medium | Biomonitoring study where pregnant women-fetus pairs recruited from cities. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported. Several summary statistics provided, including median, interquartile range, and frequency of detection. |
| | Metric 9: | Quality Assurance | Low | QA/QC not discussed. Authors cite previously peer-reviewed publications for more details on methodology. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limitation of study is discussed. Paper also discusses findings from other like studies. |
| **Overall Quality Determination** | | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | Huffman, A. M., Wu, H., Rosati, A., Rahil, T., Sites, C. K., Whitcomb, B. W., Richard Pilsner, J. (2018). Associations of urinary phthalate metabolites and lipid peroxidation with sperm mitochondrial DNA copy number and deletions. Environmental Research 163:15-Oct. |
| **HERO ID:** | 4728509 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Participants and sampling described briefly. |
| | Metric 2: | Analytical Methodology | Low | LOD range provided, CDC analyzed samples. |
| | Metric 3: | Biomarker Selection | High | Metabolite in urine. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | U.S. |
| | Metric 5: | Currency | High | 2014 and 2017. |
| | Metric 6: | Spatial and Temporal Variability | Low | n = 99, no replicates, spot urine samples. |
| | Metric 7: | Exposure Scenario | High | Biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | GM, 95%CI, % below LOD, percentiles: 25%, 50%, 75%, 95% |
| | Metric 9: | Quality Assurance | Medium | Standards, spikes, blanks, and LOD approach described. Recovery not included. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and uncertainty not discussed, no obvious concerns. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Liao, K. W., Kuo, P. L., Huang, H. B., Chang, J. W., Chiang, H. C., Huang, P. C. (2018). Increased risk of phthalates exposure for recurrent pregnancy loss in reproductive-aged women. Environmental Pollution 241:969-977. |
| **HERO ID:** | 4728516 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Participant information, sampling methods and storage conditions reported. |
| | Metric 2: | Analytical Methodology | Medium | LOD provided in text. method described previously (Huang et al.,2015; Huang et al., 2016). |
| | Metric 3: | Biomarker Selection | High | Metabolite is known to be from parent in urine. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted in Taiwan. |
| | Metric 5: | Currency | High | Study was conducted between 2013 and 2017. |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 76 (control group), n = 103 (recurrent pregnancy loss group), no replicates, urine sample details not provided. |
| | Metric 7: | Exposure Scenario | High | The study is measuring phthalates in pregnant women urine. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | The study reports detection rate %, median and range. Raw data not reported. |
| | Metric 9: | Quality Assurance | Medium | Blanks, spikes, repeated samples, and recovery included. However, the exact recovery percent is not reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability account for different ages sampled. Limitations discussed. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Hartle, J. C., Cohen, R. S., Sakamoto, P., Barr, D. B., Carmichael, S. L. (2018). Chemical contaminants in raw and pasteurized human milk. Journal of Human Lactation 34(2):340-349. |
| **HERO ID:** | 4728555 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Included only milk from women who passed screen for risk factors, medications, and serology. Milk collected in BPA-free bags and stored at CA state milk bank at -20 C. Method of milk collection by women not specified. |
| | Metric 2: | Analytical Methodology | High | Samples deglucuronidized; analyzed by isotope dilution, SPE, HPLC- negative ion electrospray-MS/MS; LODs in SI. Lipid content measured. Reviewed analytic details provided in previous publication (Calafat et al. 2004, HERO 673259). The study reported the LOD in the SI |
| | Metric 3: | Biomarker Selection | High | Analyzed breast milk, pre- and post-pasteurization, for MBzP |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were from across California |
| | Metric 5: | Currency | High | Samples were collected in 2015. |
| | Metric 6: | Spatial and Temporal Variability | High | Analyzed milk donated by 21 women from across California to CA milk bank (sample bags selected randomly from storage). Some categories of ethnicity, parity, age, CA region, and baby's age were represented by few individuals. |
| | Metric 7: | Exposure Scenario | Medium | The study evaluated the presence and co-occurrence of contaminants in human milk and the effects of pasteurization. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Raw data provided in Excel in SI, along with LOD and summary statistics (mean, SD, percentiles, range). |
| | Metric 9: | Quality Assurance | High | Used blanks, duplicate samples, and spiked QC materials (approximately 15% of samples tested); accuracy 93%-102%; RSD 7%-13%. Previous method validation was reported in HERO 673259. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Discussed possible reasons for increased phthalate concentrations after pasteurization; recognized limitations for "self-selected" nature of women donating milk and relatively small sample size. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Torres, N. I., Yu, X., Padilla, I. Y., Macchiavelli, R. E., Ghasemizadeh, R., Kaeli, D., Cordero, J. F., Meeker, J. D., Alshawabkeh, A. N. (2018). The influence of hydrogeological and anthropogenic variables on phthalate contamination in eogenetic karst groundwater systems. Environmental Pollution 237:298-307. |
| **HERO ID:** | 4728606 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The sampling methodology was described for both historical database and current study field sampling within the supplemental materials (Table S1) and included details for field sampling such as brief sampling methodology, sampling equipment, storage conditions, and duration of sample storage prior to analysis. |
| | Metric 2: | Analytical Methodology | High | The sample analysis for field samples was described in terms of analytic methodology (U.S. EPA methods 3501C and 827OD), extraction, analytical instrumentation, instrument calibration, limits of detection set at instrument detection limit of 1 microgram per Liter, and recoveries, as described within Table S1. |
| | Metric 3: | Biomarker Selection | N/A | Sampling was conducted within environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sampling was conducted within the karst region of northern Puerto Rico (KRNPR). |
| | Metric 5: | Currency | Medium | Sampling results from the historical databases (USGS, USEPA and PRDOH) was conducted 1981-2013. Sampling results from the current study field sampling was conducted 2011-2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | A total of n=2,004 samples were analyzed from historical databases (n=1,803 samples from 197 well sites and 4 springs) and current study field sampling (n=201 samples from 17 wells and 4 springs), with n=1,995, n=295, and n=89 samples analyzed for DEHP, DBP, and BBP, respectively. Authors note that duplicate samples were collected at each site for Spring and Fall samples of each year from 2011 - 2013 for field samples. Field sampling sites were selected based on proximity to potential Superfund, RCRA and landfill site contamination sources, accessibility, and spatial representation. This study specifically examined principal factors which affect phthalate concentration distributions, however BBP was not analyzed (all samples for BBP were less than the limit of detection). |
| | Metric 7: | Exposure Scenario | High | This study assessed the concentration of phthalates in groundwater of aquifers of the karst region of northern Puerto Rico (KRNPR) near contaminated sources, explored the spatial distribution patterns, and evaluated factors affecting the spatial variability of phthalate detections and concentrations. There was a high density of RCRA and Superfund sites in the region. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Summary statistics of central tendency and variation were reported for DEHP and DBP concentrations, but not BBP (all samples were less than the limit of detection) within the text. The number of samples and frequency of detection was also reported for DEHP, DBP and BBP for the total sampling database. Raw data was not presented. |
| | Metric 9: | Quality Assurance | Medium | Quality assurance/control parameters for the current study field sampling included laboratory recoveries, quality control samples analyzed every 10 samples, instrument calibration and system performance verification were detailed. Field, shipment and laboratory blanks were collected for each sampling day of the current study field sampling. Baseline, pre-exposure sampling was not conducted. Specific details of QA/QC parameters for historical databases from USGS, U.S. EPA and PRDOH were not detailed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | The characterization of variability within statistical summary measures was limited to SD/SE for DEHP and DBP (BBP was not characterized, all BBP samples within historical database were less than LOD, and BBP was not analyzed within the current study field sampling). Study limitations were outlined in detail within Table S2, and noted differences in sampling frequencies driven by regulatory requirements over the years of sampling within the historical databases as well as high variability in extraction recoveries. |

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|---|---|
| **Study Citation:** | Torres, N. I., Yu, X., Padilla, I. Y., Macchiavelli, R. E., Ghasemizadeh, R., Kaeli, D., Cordero, J. F., Meeker, J. D., Alshawabkeh, A. N. (2018). The influence of hydrogeological and anthropogenic variables on phthalate contamination in eogenetic karst groundwater systems. Environmental Pollution 237:298-307. |
| **HERO ID:** | 4728606 |

| Domain | Metric | Rating | Comments |
|---|---|---|---|
| **Overall Quality Determination** | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | Watkins, D. J., Sánchez, B. N., Téllez-Rojo, M. M., Lee, J. M., Mercado-García, A., Blank-Goldenberg, C., Peterson, K. E., Meeker, J. D. (2017). Phthalate and bisphenol A exposure during in utero windows of susceptibility in relation to reproductive hormones and pubertal development in girls. Environmental Research 159:143-151. |
| **HERO ID:** | 4728621 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Well described sampling methods. |
| | Metric 2: | Analytical Methodology | High | Detailed analytical methods, reported LOD. |
| | Metric 3: | Biomarker Selection | High | Biomarker is known to be related to external exposure. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Mexico |
| | Metric 5: | Currency | Low | Sampling began in 1997. |
| | Metric 6: | Spatial and Temporal Variability | Low | n=97, with replicates. |
| | Metric 7: | Exposure Scenario | High | Data closely represent relevant exposure scenarios. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics. |
| | Metric 9: | Quality Assurance | Medium | Limited description about QA/QC techniques. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Characterized variability, discussed uncertainties and limitations. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Duan, Y., Wang, L., Han, L., Wang, B., Sun, H., Chen, L., Zhu, L., Luo, Y. (2017). Exposure to phthalates in patients with diabetes and its association with oxidative stress, adiponectin, and inflammatory cytokines. Environment International 109(Elsevier):53-63. |
| **HERO ID:** | 4728629 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling equipment and methods are only briefly discussed, therefore certain aspects (e.g. material components of sampling vessel) are absent that may have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | High | Analytical instrumentation and methods are reported in sufficient detail, are referenced to other published studies, and are scientifically sound. LOD and LOQ are reported. |
| | Metric 3: | Biomarker Selection | High | The monoester phthalate biomarker is a metabolite of just the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Tianjin, China |
| | Metric 5: | Currency | High | May-July 2016 |
| | Metric 6: | Spatial and Temporal Variability | Low | Unpooled spot urine samples from 343 participants collected between 9:00 and 11:00 a.m. |
| | Metric 7: | Exposure Scenario | Medium | Exposure scenarios for sampled population not well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data are not reported; summary statistics include geometric mean, median, minimum, and maximum concentrations, as well as medians by various population stratifications. |
| | Metric 9: | Quality Assurance | High | QA/QC methods included the use of procedural blanks, spiked samples, and surrogate standards to determine background contamination, spiked matrix recovery, and relative standard deviation. All values were within acceptable ranges or adjustments were made to correct (in the case of background contamination). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Characterization of variability is reported, and variability across certain population stratifications is analyzed. Methodological limitations and sources of uncertainty are briefly discussed, including the limit of study population only being diabetic patients and only using one spot sample per participant. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Dales, R. E., Kauri, L. M., Cakmak, S. (2018). The associations between phthalate exposure and insulin resistance, {\ensuremath{\beta}}-cell function and blood glucose control in a population-based sample. Science of the Total Environment 612:1287-1292. |
| **HERO ID:** | 4728651 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sample methodology was not the most comprehensive. It explained a nationally representative population from Canadian Health Measures Survey (CHMS), Cycle 2, their enrollment criteria, and one ”midstream” urine sample collected per person (blood collected same day). |
| | Metric 2: | Analytical Methodology | Low | SPE UPLC-MS-MS analyses conducted by Centre de Toxicologie du Quebec as described in Saravanabhavan et al. (2013), which refers back to another study. Only the analytical method (UPLC-MS-MS) and LODs were provided. |
| | Metric 3: | Biomarker Selection | High | MBzP is a metabolite of BBzP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Participants were from Canada. |
| | Metric 5: | Currency | Medium | Participants were recruited during 2009-2011. |
| | Metric 6: | Spatial and Temporal Variability | Low | Sampling is representative of 96% of Canada. It included 2,119 individuals between 12 and 29 years of age from 18 sites across 5 regions. Only spot samples (i.e., single mid-stream) were collected per person. |
| | Metric 7: | Exposure Scenario | Medium | Questionnaire covered lifestyle factors including alcohol consumption, cigarette smoking, and physical activity. Questions related to possible sources of phthalate exposure were not included, but this is a biomonitoring study where exposure sources are difficult to pinpoint. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Data reported geometric mean, GM standard error, and interquartile range across entire sample population. Creatinine was adjusted for. No raw data were provided. |
| | Metric 9: | Quality Assurance | Low | QA/QC methods mostly missing. Authors referred to previous publications - HERO 1597648 and 1325357 - that may explain QA/QC protocols. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | There is some discussion of limitations in Discussion. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Bu, Z., Wang, J., Yu, W.,ei, Li, B. (2018). Dermal exposure to phthalates in home environment: Handwipes, influencing factors and implications. Building and Environment 133:7-Jan. |
| **HERO ID:** | 4728663 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling by wipes described. Four swipes in the same part of the hand with the same wipe to achieve max removal. Sampled air and dust as well. Process was mentioned and described elsewhere. |
| | Metric 2: | Analytical Methodology | Medium | Analytical method described, MDL estimate approach provided, but MDL values were not reported. |
| | Metric 3: | Biomarker Selection | N/A | Not a biomonitoring study. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Southwestern China, Chongqing |
| | Metric 5: | Currency | Medium | Data collected 2014 to 2015 |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicate samples collected |
| | Metric 7: | Exposure Scenario | High | Dermal, but not product or activity specific. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data reported |
| | Metric 9: | Quality Assurance | Medium | QA/QC not directly mentioned in the study - this study referenced a different study |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Statistical uncertainties discussed in Section 3.5 Limitations. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Buckley, J. P., Quirós-Alcalá, L., Teitelbaum, S. L., Calafat, A. M., Wolff, M. S., Engel, S. M. (2018). Associations of prenatal environmental phenol and phthalate biomarkers with respiratory and allergic diseases among children aged 6 and 7years. Environment International 115:79-88. |
| **HERO ID:** | 4728666 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Methodology (e.g., participant characteristics, collection methods, and storage conditions) was adequately described. |
| | Metric 2: | Analytical Methodology | High | LODs given in Table 2. Analytical methods described as solid phase extraction coupled with HPLC-isotope dilution tandem spectrometry. CDC performed the analysis, and references were also provided. |
| | Metric 3: | Biomarker Selection | High | MBzP is specific to BBzP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in New York. |
| | Metric 5: | Currency | Low | Samples were collected from 1998 to2002. |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicates were reported. Over 100 samples were analyzed. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics only and no raw data were provided. |
| | Metric 9: | Quality Assurance | Medium | Samples were adjusted for creatinine. However, no other QA/QC methods were reported but can be inferred through use of CDC laboratory for testing. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Table 2 characterizes variance. Uncertainties and limitations were discussed. |

## Overall Quality Determination High

**Study Citation:** Albert, O., Huang, J. Y., Aleksa, K., Hales, B. F., Goodyer, C. G., Robaire, B., Chevrier, J., Chan, P. (2018). Exposure to polybrominated diphenyl ethers and phthalates in healthy men living in the greater Montreal area: A study of hormonal balance and semen quality. Environment International 116:165-175.

**HERO ID:** 4728683

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The sampling methods, demographics, materials and storage were reported in this biomonitoring study. |
| | Metric 2: | Analytical Methodology | Medium | The analytical methods, instrument, LOD and LOQ were reported for hair and urine. Recovery samples were not reported by study authors. |
| | Metric 3: | Biomarker Selection | High | The study reported acceptable biomarkers. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in Montreal, Canada. |
| | Metric 5: | Currency | Medium | Data were collected between 2009 and 2012. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Samples were collected from 153 men but there were no replicate samples collected. |
| | Metric 7: | Exposure Scenario | Medium | It is unclear where the sources of exposure come from. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics reported in Table 2. Raw data were not reported by the study authors. |
| | Metric 9: | Quality Assurance | Medium | Some QA was implied but some important QC components were not reported such as recovery samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Some gaps and limitations were reported. Variability captured through different demographics of participants studied. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Bedrosian, L. D., Ferguson, K. K., Cantonwine, D. E., Mcelrath, T. F., Meeker, J. D. (2018). Urinary phthalate metabolite concentrations in relation to levels of circulating matrix metalloproteinases in pregnant women. Science of the Total Environment 613-614:1349-1352. |
| **HERO ID:** | 4728685 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology is only briefly discussed but study participants are described in another study. Storage conditions are reported. However, equipment to collect the samples are not reported. |
| | Metric 2: | Analytical Methodology | Low | Analytical methodology is reported to have followed a modified version of LC-MS/MS method developed by the CDC and is referenced to another study. However, detection limits are not reported. |
| | Metric 3: | Biomarker Selection | Low | The monoester phthalate biomarker is a metabolite of multiple parent chemicals, not just the chemical of interest, and there is not a stated method to apportion the estimate to just the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Boston, United States. |
| | Metric 5: | Currency | Medium | Samples were collected 2006-2008. |
| | Metric 6: | Spatial and Temporal Variability | Low | Unpooled spot urine samples from 134 participants at one timepoint. |
| | Metric 7: | Exposure Scenario | High | The study is measuring phthalate concentrations in pregnant women. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data are not reported; summary statistics include geometric mean, maximum, and percentiles (25, 50, 75, 95) of biomarker concentration. |
| | Metric 9: | Quality Assurance | Low | Quality assurance/quality control techniques and results were not directly discussed, but can be implied through the study's use of standard laboratory protocols. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Characterization of variability is reported, and limitations of the study are discussed (i.e., acknowledgement of the limited statistical power of the exploratory study with small sample size). |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Savoca, D., Arculeo, M., Barreca, S., Buscemi, S., Caracappa, S., Gentile, A., Persichetti, M. F., Pace, A. (2018). Chasing phthalates in tissues of marine turtles from the Mediterranean sea. Marine Pollution Bulletin 127:165-169. |
| **HERO ID:** | 4728695 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | sample collection details limited "13 turtles found dead stranded in 2016 along the Sicilian coasts" |
| | Metric 2: | Analytical Methodology | High | extraction described; HPLC method described; LOD and LOQ range provided |
| | Metric 3: | Biomarker Selection | N/A | sampling of sea turtles |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sicily |
| | Metric 5: | Currency | High | 2016 |
| | Metric 6: | Spatial and Temporal Variability | High | n = 13 turtles. |
| | Metric 7: | Exposure Scenario | Low | Sampling of turtles does not directly tie with exposures of interest. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Figure 1-4 - unclear what summary statistic the bar graphs represent. |
| | Metric 9: | Quality Assurance | Medium | quality not discussed; no obvious concerns |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | variability and uncertainty not discussed; no obvious concerns |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Shu, H., Wikstrom, S., Jönsson, B. A. G., Lindh, C. H., Svensson, Å., Nånberg, E., Bornehag, C. G. (2018). Prenatal phthalate exposure was associated with croup in Swedish infants. Acta Paediatrica 107(6):1011-1019. |
| **HERO ID:** | 4728698 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Most key criteria sampling methodology briefly described; lack of sample storage duration prior to analysis, however sample collection methods referenced. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Analytical methodology briefly described, chemical-specific limits of detection reported; lack of calibration data, however analytic methods referenced. |
| | Metric 3: | Biomarker Selection | Low | Low. Sampling for metabolites not specific for parent chemicals of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Samples provided by participants in Varmland, Sweden. |
| | Metric 5: | Currency | Medium | Medium. Samples collected 2007-2010. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Medium. Participants recruited from Varmland, Sweden county with urban, suburban and rural areas (Bornehag, 2012 reference) during 2007-2010; single first-morning urines at median gestational week 10 time period provided by all (n=1,062) participants; non-statistical sampling methodology |
| | Metric 7: | Exposure Scenario | Medium | Medium. Participant characteristics described, occupational exposure, exposure sources not described. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Most key criteria met; lack of raw data. |
| | Metric 9: | Quality Assurance | Medium | Medium. Quality assurance procedures not described, lack of pre-exposure/baseline samples, however sampling and analytic methods referenced (Bornehag, 2012) with QC procedures briefly described. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Medium. Variability described within statistical summary measures, potential study limitations minimally described and comparisons with previous literature presented. |
| **Overall Quality Determination** | | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | Soomro, M. H., Baiz, N., Philippat, C., Vernet, C., Siroux, V., Nichole Maesano, C., Sanyal, S., Slama, R., Bornehag, C. G., Annesi-Maesano, I. (2018). Prenatal exposure to phthalates and the development of eczema phenotypes in male children: results from the EDEN mother-child cohort study. Environmental Health Perspectives 126(2):027002. |
| **HERO ID:** | 4728712 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Concise but scientifically sound methods. |
| | Metric 2: | Analytical Methodology | Medium | Limited description, reported LOD. |
| | Metric 3: | Biomarker Selection | High | Biomarker known to be related to external exposure. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | France |
| | Metric 5: | Currency | High | Published in 2018. |
| | Metric 6: | Spatial and Temporal Variability | Low | n=604, no replicates. |
| | Metric 7: | Exposure Scenario | Medium | Data likely represent relevant exposure scenarios, missing details about the source and exposure characteristics. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics. |
| | Metric 9: | Quality Assurance | Low | QA/QC techniques were not discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Characterized variability, discussed uncertainties and limitations. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Smarr, M. M., Kannan, K., Sun, L., Honda, M., Wang, W., Karthikraj, R., Chen, Z., Weck, J., Buck Louis, G. M. (2018). Preconception seminal plasma concentrations of endocrine disrupting chemicals in relation to semen quality parameters among male partners planning for pregnancy. Environmental Research 167:78-86. |
| **HERO ID:** | 4728828 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Detailed sampling methods. |
| | Metric 2: | Analytical Methodology | Medium | Well described analytical methods, did not report LOD. |
| | Metric 3: | Biomarker Selection | High | Biomarker is known to be related with external exposure. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | USA |
| | Metric 5: | Currency | Medium | Sampling began in 2005. |
| | Metric 6: | Spatial and Temporal Variability | Low | n=501 study participants, with duplicate samples. |
| | Metric 7: | Exposure Scenario | Medium | Limited information about the source and microenvironment. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics. |
| | Metric 9: | Quality Assurance | Low | QA/QC techniques only briefly discussed, cited previously published work. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Characterized variability and discussed study limitations. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Gupta, S., Gadi, R. (2018). Temporal variation of phthalic acid esters (PAEs) in ambient atmosphere of Delhi. Bulletin of Environmental Contamination and Toxicology 101(2):153-159. |
| **HERO ID:** | 4728875 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling equipment and methods are described in sufficient detail, but certain aspects (e.g. duration of storage) were absent that are unlikely to have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | High | Analytical instrumentation and methods are described in sufficient detail and are scientifically sound. LOD and LOQ are reported for each analyte. |
| | Metric 3: | Biomarker Selection | N/A | This study is testing for the parent chemical of interest in an environmental medium. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Delhi, India |
| | Metric 5: | Currency | High | 2015 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 24h particulate matter samples from one site collected 2-3 times per week for one year (for a total of 69 samples), but no replicates. |
| | Metric 7: | Exposure Scenario | High | The sampling site is well characterized based on surrounding area, traffic, population, pollution, and weather patterns. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Raw data are not reported; one unspecified summary statistic for concentration is provided, which is inferred to be the mean value. |
| | Metric 9: | Quality Assurance | High | QA/QC measures included the use of external standards, field blank samples, spiked blanks, and triplicate analyses to determine calibration, recoveries, reproducibility, LOD and LOQ; all were reported within acceptable ranges. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Characterization of variability is absent, as is any discussion of limitations or sources of uncertainty. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Chen, Y., Lv, D., Li, X., Zhu, T. (2018). PM2.5-bound phthalates in indoor and outdoor air in Beijing: Seasonal distributions and human exposure via inhalation. Environmental Pollution 241:369-377. |
| **HERO ID:** | 4728877 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methods, site, equipment, calibration and storage reported. |
| | Metric 2: | Analytical Methodology | Low | Analytical methods, instrument and blanks reported. LOD nor LOQ reported |
| | Metric 3: | Biomarker Selection | N/A | Study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in Beijing, China. |
| | Metric 5: | Currency | Medium | Data collected from 2014 to 2016. |
| | Metric 6: | Spatial and Temporal Variability | High | 114-226 samples taken with no replicates. |
| | Metric 7: | Exposure Scenario | Medium | Source of exposure is from indoor environments, but the exact source is unknown. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics are reported. Raw data not provided. |
| | Metric 9: | Quality Assurance | High | QA was reported with high recovery rates for all the phthalates (>70%). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability characterized through different settings sampled. Gaps and limitations not characterized. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Weiss, J. M., Gustafsson, Å., Gerde, P., Bergman, Å., Lindh, C. H., Krais, A. M. (2018). Daily intake of phthalates, MEHP, and DINCH by ingestion and inhalation. Chemosphere 208:40-49. |
| **HERO ID:** | 4728899 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some sampling methods not reported, such as sample storage conditions. Pooled school dust sampling was not explained to people collecting samples and hence potential differences in collection. |
| | Metric 2: | Analytical Methodology | Medium | Some analytical methods not reported, such as recovery samples. |
| | Metric 3: | Biomarker Selection | N/A | Not biomonitoring samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sweden |
| | Metric 5: | Currency | Medium | Not reported. FORMAS project is dated to 2012, but sampling could have occurred at various times. Sampling time can range from 2012 to 2018. |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicates. |
| | Metric 7: | Exposure Scenario | Medium | Household dust collected from children's sleeping roomsand from living rooms and in schools at three locations inSweden. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not provided. |
| | Metric 9: | Quality Assurance | Medium | LOD reported, recovery samples not reported. Blanks and other QC samples were used to discuss results. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported. |
| **Overall Quality Determination** | | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | Wenzel, A. G., Bloom, M. S., Butts, C. D., Wineland, R. J., Brock, J. W., Cruze, L., Unal, E. R., Kucklick, J. R., Somerville, S. E., Newman, R. B. (2018). Influence of race on prenatal phthalate exposure and anogenital measurements among boys and girls. Environment International 110:61-70. |
| **HERO ID:** | 4728953 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Most key criteria met, lack of duration of sample storage prior to analysis. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Most key criteria met, LOD's reported, specific gravity considerations for matrix adjustment, lack of recovery data. |
| | Metric 3: | Biomarker Selection | Low | Low. Metabolites not specific for parent chemicals. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Samples collected from participants in Charleston, SC. |
| | Metric 5: | Currency | Medium | Medium. Samples collected from pregnant women recruited 2011-2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Medium. Single spot urine specimens collected from main study, subsample gave a second sample, total participating = 380 women, non-statistical sampling method. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Participant characteristics reported in Table 1, some discussion of potential exposure sources, lack of control samples. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Most key criteria met, lack of raw data. |
| | Metric 9: | Quality Assurance | Medium | Medium. Standard QC methods reported, most key criteria met, recoveries reported, lack of pre-exposure samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Medium. Variability described in terms of statistical summary measures, limitations of sampling during gestational weeks (GW) 18-20 rather than earlier, etiologically relevant GW 7-13 noted. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Baurès, E., Blanchard, O., Mercier, F., Surget, E., le Cann, P., Rivier, A., Gangneux, J. P., Florentin, A. (2018). Indoor air quality in two French hospitals: Measurement of chemical and microbiological contaminants. Science of the Total Environment 642:168-179. |
| **HERO ID:** | 4729972 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The air sampling methodology was described in detail. |
| | Metric 2: | Analytical Methodology | Medium | The analytical methods were described and included LOD/LOQ but not recoveries. |
| | Metric 3: | Biomarker Selection | N/A | The authors analyzed air samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in France. |
| | Metric 5: | Currency | Medium | The samples were collected between June 2014 and February 2015 |
| | Metric 6: | Spatial and Temporal Variability | High | n>10 air samples, with replicates. |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant exposure scenarios related indoor airborne pollutants in French Hospitals. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | The authors reported summary statistics and raw data. |
| | Metric 9: | Quality Assurance | High | The authors described QA/QC techniques in detail. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability was characterized (SD, range). Little information was reported on limitations and gaps. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Ait Bamai, Y., Araki, A., Nomura, T., Kawai, T., Tsuboi, T., Kobayashi, S., Miyashita, C., Takeda, M., Shimizu, H., Kishi, R. (2018). Association of filaggrin gene mutations and childhood eczema and wheeze with phthalates and phosphorus flame retardants in house dust: The Hokkaido study on Environment and Children's Health. Environment International 121(Pt 1):102-110. |
| **HERO ID:** | 4829235 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The authors report the microenvironment of the dust collection (living room floor), and the sampling equipment. They also reported the storage conditions but not the storage duration. |
| | Metric 2: | Analytical Methodology | Medium | The authors referred to another paper regarding the methods, but they reported the analytical method used and instrumentation. The authors reported LOQ. |
| | Metric 3: | Biomarker Selection | N/A | NA - Dust sample no biomarker needed. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Hokkaido Japan. |
| | Metric 5: | Currency | Medium | Samples were collected in 2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | The study collected 888 house dust samples, however they did not collect replicate samples. |
| | Metric 7: | Exposure Scenario | Medium | The exposure scenario is relevant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | The authors report the detection frequency, min, max, 25 and 75%. They also reported the number of samples in the data set. No standard deviation was reported, nor individual concentrations. |
| | Metric 9: | Quality Assurance | Medium | The authors refer to another paper regarding their quality control and assurance methods. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | The authors address limitations of the study, variance was reported in terms of percentiles. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Malits, J., Attina, T. M., Karthikraj, R., Kannan, K., Naidu, M., Furth, S., Warady, B. A., Vento, S., Trachtman, H., Trasande, L. (2018). Renal function and exposure to bisphenol A and phthalates in children with chronic kidney disease. Environmental Research 167:575-582. |
| **HERO ID:** | 4829246 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sample storage duration is unclear. |
| | Metric 2: | Analytical Methodology | Low | The main study does not include information on analytical methods, but states that detailed methods can be found in the supplementary materials for the article. |
| | Metric 3: | Biomarker Selection | Medium | The biomarker (urine) is acceptable. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was performed in the USA. |
| | Metric 5: | Currency | Medium | The majority of samples were collected from 2005 to 2008, and some were collected between 2009 and 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | There were 538 study participants. Samples were fresh void samples, not 24-hr samples. |
| | Metric 7: | Exposure Scenario | Medium | The data likely represent the exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Results we're adjusted for urinary creatine. Mean values with 95% confidence intervals were reported. Raw data were not included in the main study (it is unclear whether these data are contained in the supplementary materials). |
| | Metric 9: | Quality Assurance | Low | The study reports that no QC/QC measures were in place during sampling. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study included a brief discussion of the limitations of its cross-sectional design. |
| **Overall Quality Determination** | | | **Medium** | |

**Study Citation:** Amin, M. M., Ebrahimpour, K., Parastar, S., Shoshtari-Yeganeh, B., Hashemi, M., Mansourian, M., Poursafa, P., Fallah, Z., Rafiei, N., Kelishadi, R. (2018). Association of urinary concentrations of phthalate metabolites with cardiometabolic risk factors and obesity in children and adolescents. Chemosphere 211:547-556.

**HERO ID:** 4829277

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some aspects of sampling methods not reported, most notably whether the urine samples were first voids, 24-hour samples, or another type (as well as how they were collected and stored). |
| | Metric 2: | Analytical Methodology | Low | Limits of detection were not identified. Some aspects of analytical methods were not reported, such as recovery samples and instrument calibration. |
| | Metric 3: | Biomarker Selection | Low | Metabolites were measured in urine. However, one metabolite could be derived from multiple parents (including this chemical), and no effort was made to apportion it. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Isfahan, Iran |
| | Metric 5: | Currency | High | Samples collected in 2016 |
| | Metric 6: | Spatial and Temporal Variability | Low | There were >10 samples, but no replicates. It is unclear whether the urine samples were 24-hour samples, first morning voids, or another type. Since they were likely spot samples collected when the children also provided blood samples, I rated this as low. |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized, but surveys were used to assess use of certain products that may have been sources of phthalates, such as bottled beverages, cosmetics, etc. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported, but means, medians, standard deviations, and number of detections reported. |
| | Metric 9: | Quality Assurance | Low | QA was not discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | There was little discussion of uncertainty, but some limitations (e.g., just one snapshot in time, correlation does not demonstrate causation) were discussed. The sources of variability included whether children had entered puberty, which was not assessed, and use of products that may have increased exposure to phthalates, which was assessed. |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | Gao, X., Huang, C., Rao, K., Xu, Y., Huang, Q., Wang, F., Ma, M., Wang, Z. (2018). Occurrences, sources, and transport of hydrophobic organic contaminants in the waters of Fildes Peninsula, Antarctica. Environmental Pollution 241:950-958. |
| **HERO ID:** | 4829317 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Antarctica |
| | Metric 5: | Currency | High | Samples collected in 2015 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 5-10 samples; replicates |
| | Metric 7: | Exposure Scenario | Medium | exposure source not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | raw data reported |
| | Metric 9: | Quality Assurance | High | Key QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Few gaps and limitations reported |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Ramzi, A., Gireeshkumar, T. R., Habeeb Rahman, K., Manu, M., Balachandran, K. K., Chacko, J., Chandramohanakumar, N. (2018). Distribution and contamination status of phthalic acid esters in the sediments of a tropical monsoonal estuary, Cochin - India. Chemosphere 210(Elsevier):232-238. |
| **HERO ID:** | 4829338 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods (e.g., location, site characteristics, equipment, collection regimen) were reported. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods (e.g., instrumentation, extraction, LODs/LOQs, recoveries) were reported. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in sediment. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Cochin, India. |
| | Metric 5: | Currency | Medium | Samples were collected in 2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Samples were collected from 15 locations. Authors reported that several deployments were made to obtain a well-preserved samples, but it is unclear if that means replicates were collected. |
| | Metric 7: | Exposure Scenario | High | The introduction describes sources of phthalates to the estuary and how it can pose an ecological hazard. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. |
| | Metric 9: | Quality Assurance | High | Key QA/QC were reported. Recoveries were acceptable. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variance characterized with ranges. Gaps and limitations were only briefly reported. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Paluselli, A., Fauvelle, V., Schmidt, N., Galgani, F., Net, S., Sempéré, R. (2018). Distribution of phthalates in Marseille Bay (NW Mediterranean Sea). Science of the Total Environment 621:578-587. |
| **HERO ID:** | 4829461 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The sampling method is clear and appropriate, and includes details such as sample storage, sample storage duration and sampler calibration. |
| | Metric 2: | Analytical Methodology | High | The analytical methodology is clear and appropriate. A range of LODs is provided for the chemicals. |
| | Metric 3: | Biomarker Selection | N/A | Study is testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Marseille Bay, France. |
| | Metric 5: | Currency | Medium | Samples were collected from Dec 2013 to Nov 2014. |
| | Metric 6: | Spatial and Temporal Variability | High | A total of 72 water samples were collected monthly at multiple seawater depths of 0.5, 5, 15 and 30 meters for surface and bottom seawater level sampling over a period of one year. Duplicate samples were reported. |
| | Metric 7: | Exposure Scenario | High | The exposure scenario is surface water in a bay in France at various depths. The scenario is well characterized with details such as the microclimate and potential sources provided. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Concentrations of chemical were provided in Table 1, including range, average, and standard deviation. No raw data was provided. |
| | Metric 9: | Quality Assurance | Medium | QA/QC measures are reported, including the use of a method blank and a spike blank. No major issues were identified. It was noted that occasionally DiBP, DBP and DEHP were detected in blanks but in concentrations that were below the limits of detection. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Standard deviations are provided in Table 1 and there is discussion of variability and uncertainty in the results and discussion section. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Zhang, H., Zhou, Q., Xie, Z., Zhou, Y., Tu, C., Fu, C., Mi, W., Ebinghaus, R., Christie, P., Luo, Y. (2018). Occurrences of organophosphorus esters and phthalates in the microplastics from the coastal beaches in north China. Science of the Total Environment 616-617:1505-1512. |
| **HERO ID:** | 4829473 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some methods not reported such as sample storage conditions. More information provided in other references stated. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported, including extraction methods, analytical instrument, LOD provided in supplementary file. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected in China. |
| | Metric 5: | Currency | High | Samples collected in 2015. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 28 samples collected. No replicates mentioned. |
| | Metric 7: | Exposure Scenario | High | Samples collected from the sand near the sea. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported. Summary statistics such as mean, median, range reported. |
| | Metric 9: | Quality Assurance | High | Key QA reported. Procedural blanks and high recoveries reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Gaps and limitations not reported. Variation, such as SD, comparison to other studies, and spatial analysis reported. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Kuzukiran, O., Yurdakok-Dikmen, B., Sevin, S., Sireli, U. T., Iplikcioglu-Cil, G., Filazi, A. (2018). Determination of selected endocrine disruptors in organic, free-range, and battery-produced hen eggs and risk assessment. Environmental Science and Pollution Research 25(35):35376-35386. |
| **HERO ID:** | 4938680 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sample collection was described. Site matrix and characteristics were provided. And storage condition was described. |
| | Metric 2: | Analytical Methodology | High | GC-MS was used to analyze the chemicals. LOD and LOQ were reported. |
| | Metric 3: | Biomarker Selection | N/A | Environmental media |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Ankara, Turkey |
| | Metric 5: | Currency | High | March to May 2017 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 50 battery-hen eggs were collected from ten cages |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Supplementary or raw data (i.e., individual data points) are not reported, and therefore summary statistics cannot be reproduced. |
| | Metric 9: | Quality Assurance | High | The study applied quality assurance/quality control measures and all pertinent quality assurance information is provided. (Table 3) |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study has limited discussion of key uncertainties, limitations, and data gaps. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Okeme, J. O., Nguyen, L. V., Lorenzo, M., Dhal, S., Pico, Y., Arrandale, V. H., Diamond, M. L. (2018). Polydimethylsiloxane (silicone rubber) brooch as a personal passive air sampler for semi-volatile organic compounds. Chemosphere 208:1002-1007. |
| **HERO ID:** | 5017615 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Personal air sampling methodology described within text as incorporating passive polydimethylsiloxane brooch samplers worn within breathing zone of participants, samples stored in air tight glass jars and frozen pending analysis, extensive calibration study of passive samplers compared with active sampling pumps conducted prior to field study described with field study conducted on participants instructed to stay indoors unless going to/from work. Insufficient information on sample storage time prior to analysis. Sampling methodology within field study unclear as to distribution/collection times of passive samplers—it is unclear if passive sampling brooches were collected daily or if single brooches were worn for seven consecutive days. |
| | Metric 2: | Analytical Methodology | Medium | Extraction methods and analytical instrumentation as GC-MS/ENCI described with data on detection limits and recovery samples described within SI and noted to have met criteria from previous references (Saini et al., 2015; Okeme et al., 2016b). Insufficient information on instrument calibration, although this information may be provided within SI. |
| | Metric 3: | Biomarker Selection | N/A | Personal passive air sampling results with brooch and active sampling pump for parent chemicals of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Canada. |
| | Metric 5: | Currency | High | Sampling conducted in winter of 2016. |
| | Metric 6: | Spatial and Temporal Variability | Low | Field study consisted of three volunteers wearing badges for seven days with unclear methodology description of when/if passive sampling brooches were retrieved and replaced daily or if a single brooch was worn for 24 hours during seven day period. No duplicate/replicate sampling conducted, however 24-hour sampling conducted. |
| | Metric 7: | Exposure Scenario | Medium | Participants are office workers who were instructed to remain indoors (work/home) for the period of study other than transportation to/from work. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Raw data in terms of passive personal brooch sampling results for each participant reported within Table 1, with additional data from calibration in SI. Insufficient information on exact sampling dates, although sampling reported as conducted during “winter of 2016”. Insufficient information on summary statistics as only single brooch concentrations, without range, number of brooches, etc. provided. Frequency of detection information described as detailed within SI. |
| | Metric 9: | Quality Assurance | Medium | Recovery and QC data described as detailed within SI (S3). Results described as blank and recovery corrected as appropriate. Pre-exposure sampling not conducted. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Insufficient information on variability characterization as no range or SD information provided for sampling results. Limitations of small sample size (n=3 participants for field study) as well as lack of individual activity data noted. Some uncertainty with effects of humidity on passive sampling brooch while left within bathroom during shower/bathing activities not noted by authors. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Balalian, A. A., Whyatt, R. M., Liu, X., Insel, B. J., Rauh, V. A., Herbstman, J., Factor-Litvak, P. (2019). Prenatal and childhood exposure to phthalates and motor skills at age 11 years. Environmental Research 171:416-427. |
| **HERO ID:** | 5039985 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Most key criteria not described. Sampling equipment, sample storage conditions, duration of sample storage, lacking. |
| | Metric 2: | Analytical Methodology | Medium | Some key criteria briefly described, samples analyzed by CDC with methodology referenced, chemical-specific LOD's reported. |
| | Metric 3: | Biomarker Selection | Low | Sampling for metabolites not specific for parent chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples provided by participants in Harlem and New York, New York hospitals. |
| | Metric 5: | Currency | Medium | Prenatal spot urine samples collected 1998-2006; age three urines collected 2002-2008; age 5 urines collected 2004-2009; age 7 urines collected 2005-2009. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Single prenatal 3rd trimester spot urine specimens obtained from n=300 participants 1998-2006; repeated urines collected across ages 3, 5 and 7 for children of mother participants 2002-2009. |
| | Metric 7: | Exposure Scenario | Medium | Participant characteristics summarized, lack of information on pre-exposure or control samples. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Most key criteria met; lack of raw data. |
| | Metric 9: | Quality Assurance | Medium | Quality assurance procedures not described however analytic methods referenced and samples noted as analyzed at CDC labs. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability characterized within summary statistics, potential study limitations discussed. |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | Chen, Y., Jiang, L., Lu, S., Kang, L., Luo, X., Liu, G., Cui, X., Yu, Y. (2019). Organophosphate ester and phthalate ester metabolites in urine from primiparas in Shenzhen, China: Implications for health risks. Environmental Pollution 247:944-952. |
| **HERO ID:** | 5039996 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology is adequately described. |
| | Metric 2: | Analytical Methodology | Medium | LOQ is not stated in the main article, but is reportedly provided in the supplemental materials for this article. |
| | Metric 3: | Biomarker Selection | High | The biomarker (metabolite in urine samples) is appropriate. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Participants were recruited in Shenzhen Maternal and Child Health Hospital (China). |
| | Metric 5: | Currency | High | Samples were collected between September 2013 and June 2015. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Samples collected from 84 Primiparas but no replicates. First-morning voids were collected as opposed to 24-hr sampling. |
| | Metric 7: | Exposure Scenario | High | The data represent the population of interest. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics were detailed and complete but individual data points and measures of variance were not reported. |
| | Metric 9: | Quality Assurance | High | Recoveries were measured, and blanks were analyzed. Glassware was cleaned and heated to minimize background contamination. Results were normalized by specific gravity. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No measure of variance is reported. The study briefly discussed its primary limitation (small sample size). |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Zhu, Q., Jia, J., Zhang, K., Zhang, H., Liao, C., Jiang, G. (2019). Phthalate esters in indoor dust from several regions, China and their implications for human exposure. Science of the Total Environment 652:1187-1194. |
| **HERO ID:** | 5041236 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology is thoroughly described and scientifically sound. No key details are omitted. |
| | Metric 2: | Analytical Methodology | High | Analytical method is thoroughly described and sound. LOD and LOQ is provided in the text. |
| | Metric 3: | Biomarker Selection | N/A | Study is testing for parent chemical in dust. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected in China. |
| | Metric 5: | Currency | High | Samples collected from 2017-2018. |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicates provided. |
| | Metric 7: | Exposure Scenario | High | The source of exposure was well characterized and this is an exposure scenario of interest. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data is not provided, but summary statistics are given. |
| | Metric 9: | Quality Assurance | High | QA/QC methods are provided and no issues were identified. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited gaps and limitations are reported. Characterization of variability is limited but the range is provided. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Martinez, R. M., Hauser, R., Liang, L., Mansur, A., Adir, M., Dioni, L., Racowsky, C., Bollati, V., Baccarelli, A. A., Machtinger, R. (2019). Urinary concentrations of phenols and phthalate metabolites reflect extracellular vesicle microRNA expression in follicular fluid. Environment International 123:20-28. |
| **HERO ID:** | 5041241 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The urine sampling methodology was described in detail and is scientifically sound. |
| | Metric 2: | Analytical Methodology | Medium | The analytical methods were described and included LODs but did not include recoveries. |
| | Metric 3: | Biomarker Selection | High | The metabolites closely represent exposure to phthalates. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The samples were collected in Israel |
| | Metric 5: | Currency | High | The samples were collected between 2014 and 2016. |
| | Metric 6: | Spatial and Temporal Variability | Low | n=130, some study participants provided duplicate samples. |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant scenarios related to phthalate exposure |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics were reported (median, IQR, max) |
| | Metric 9: | Quality Assurance | Medium | QA/QC techniques were mentioned but not described in detail. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability was characterized (IQR, max). Uncertainties and study limitations were discussed. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Nassan, F. L., Williams, P. L., Gaskins, A. J., Braun, J. M., Ford, J. B., Calafat, A. M., Hauser, R. (2019). Correlation and temporal variability of urinary biomarkers of chemicals among couples: Implications for reproductive epidemiological studies. Environment International 123:181-188. |
| **HERO ID:** | 5041439 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Well described |
| | Metric 2: | Analytical Methodology | High | LOD reported. Standard methods. |
| | Metric 3: | Biomarker Selection | High | Strong relationship with parent. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Boston |
| | Metric 5: | Currency | Medium | 2004 to 2017 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Hundreds of samples and hundreds of participants. Replicate samples (men and women on same day). Unpooled spot urine samples. Multiple samples per person, so treat as if pooled. |
| | Metric 7: | Exposure Scenario | Low | Matches exposure scenario for couples seeking fertility treatments, so may not be representative of US population. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Summary statistics only. Downgraded to Low because I cannot tell if the summary statistics are per person (best) or per sample. |
| | Metric 9: | Quality Assurance | Low | QA/QC not discussed. SG adjustment. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Uncertainties and limitations discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Velázquez-Gómez, M., Hurtado-Fernández, E., Lacorte, S. (2019). Differential occurrence, profiles and uptake of dust contaminants in the Barcelona urban area. Science of the Total Environment 648:1354-1370. |
| **HERO ID:** | 5043338 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Dust sampling methods were included and described (Velázquez-Gómez et al., 2018). Sample collection was performed by gently collecting the accumulation of the settled dust. In houses, cars and in the public places where we had access, the samples were collected by scientific staff with a Bosch BKS4 (14.4 V) vacuum cleaner. |
| | Metric 2: | Analytical Methodology | Medium | GC-EI-MS/MS analysis. All QA/QC measures reported except reporting limits were not reported in the text. |
| | Metric 3: | Biomarker Selection | N/A | They did not test for biomarkers; tested for parent chemicals in dust samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected in Spain. |
| | Metric 5: | Currency | Low | Sampling date was not reported, but publication date is available, 2019. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Authors did not collect replicate samples. |
| | Metric 7: | Exposure Scenario | Medium | Table 1 presents sample site characteristics, but does not include indoor characteristics such as air flow. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Authors did not calculate standard deviation or other measure of variation (besides IQR). |
| | Metric 9: | Quality Assurance | Medium | QA/QC techniques were discussed, but authors did not report sample recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Authors provided limited discussion on key data uncertainties. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Bi, C., Maestre, J. P., Li, H., Zhang, G., Givehchi, R., Mahdavi, A., Kinney, K. A., Siegel, J., Horner, S. D., Xu, Y. (2018). Phthalates and organophosphates in settled dust and HVAC filter dust of U.S. low-income homes: Association with season, building characteristics, and childhood asthma. Environment International 121(Pt 1):916-930. |
| **HERO ID:** | 5043341 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology described, sample storage provided, comparison between two settled dust sampling methods |
| | Metric 2: | Analytical Methodology | Medium | LOD or LOQ not provided but MDLs are reported. Instrumentation and analytical was briefly described and is acceptable. |
| | Metric 3: | Biomarker Selection | N/A | NA - dust samples biomarker not needed. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Texas, USA |
| | Metric 5: | Currency | Medium | Data collected 2014 to 2015. winter (December 2014–February 2015 and summer (June 2014–September 2014) seasons |
| | Metric 6: | Spatial and Temporal Variability | High | 54 homes, multiple types of samples (91 for HVAC and 92 for settled dust). Two small replicate cuts per filter |
| | Metric 7: | Exposure Scenario | High | Indoor dust low income homes rural/semi rural areas. Collection of HVAC particulate is more representative of breathable and inhalable particles then from settled dust |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data reported. Summary stats and figures available |
| | Metric 9: | Quality Assurance | High | Blanks, recovery spikes and standards are used correctly |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Statistical analysis appropriate and discussion of limitations was adequate |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Reeves, K. W., Santana, M. D., Manson, J. E., Hankinson, S. E., Zoeller, R. T., Bigelow, C., Hou, L., Wactawski-Wende, J., Liu, S., Tinker, L., Calafat, A. M. (2019). Predictors of urinary phthalate biomarker concentrations in postmenopausal women. Environmental Research 169:122-130. |
| **HERO ID:** | 5043403 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some sampling methods not reported such as sampler calibration |
| | Metric 2: | Analytical Methodology | Medium | Recovery samples not reported |
| | Metric 3: | Biomarker Selection | High | Acceptable biomarker |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | United States |
| | Metric 5: | Currency | Low | Samples collected between 1993 and 1998 |
| | Metric 6: | Spatial and Temporal Variability | High | >10 samples; replicates |
| | Metric 7: | Exposure Scenario | High | Exposure sources characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported |
| | Metric 9: | Quality Assurance | Medium | Key QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Some limitations reported |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Rabhi, L., Lemou, A., Cecinato, A., Balducci, C., Cherifi, N., Ladji, R., Yassaa, N. (2018). Polycyclic aromatic hydrocarbons, phthalates, parabens and other environmental contaminants in dust and suspended particulates of Algiers, Algeria. Environmental Science and Pollution Research 25(24):24253-24265. |
| **HERO ID:** | 5043419 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Detailed sampling methodology. |
| | Metric 2: | Analytical Methodology | High | Includes LOD and LOQ. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Algeria |
| | Metric 5: | Currency | High | Samples from 2016. |
| | Metric 6: | Spatial and Temporal Variability | High | Includes replicates, 36 indoor samples, 92 outdoor samples. |
| | Metric 7: | Exposure Scenario | High | Data closely represents a relevant exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data nor reported, only summary statistics. |
| | Metric 9: | Quality Assurance | High | Controls and recovery samples were analyzed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Key uncertainties and limitations are not discussed. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Rodríguez-Carmona, Y., Cantoral, A., Trejo-Valdivia, B., Téllez-Rojo, M. M., Svensson, K., Peterson, K. E., Meeker, J. D., Schnaas, L., Solano, M., Watkins, D. J. (2019). Phthalate exposure during pregnancy and long-term weight gain in women. Environmental Research 169:26-32. |
| **HERO ID:** | 5043451 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Only briefly described. |
| | Metric 2: | Analytical Methodology | High | Well described analytical methods, reported LOD in supplemental material. |
| | Metric 3: | Biomarker Selection | High | Biomarker is known to be related to external exposure. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Mexico |
| | Metric 5: | Currency | Low | Sampling began in 1997. |
| | Metric 6: | Spatial and Temporal Variability | Low | n=178, with 4 replicates. |
| | Metric 7: | Exposure Scenario | High | Data closely represent relevant exposure scenarios. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics. |
| | Metric 9: | Quality Assurance | Medium | Limited description about QA/QC techniques. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Characterized variability, discussed uncertainties and limitations. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Shaffer, R. M., Ferguson, K. K., Sheppard, L., James-Todd, T., Butts, S., Chandrasekaran, S., Swan, S. H., Barrett, E. S., Nguyen, R., Bush, N., Mcelrath, T. F., Sathyanarayana, S. (2019). Maternal urinary phthalate metabolites in relation to gestational diabetes and glucose intolerance during pregnancy. Environment International 123:588-596. |
| **HERO ID:** | 5043458 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most key criteria met, sampling methodology briefly described; lack of sample storage duration prior to analysis. |
| | Metric 2: | Analytical Methodology | Medium | Analytical methodology briefly described, limits of detection reported as range, however analytic methods referenced. |
| | Metric 3: | Biomarker Selection | Low | Sampling for metabolites not specific for parent chemicals of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples provided by participants in California, Minnesota, New York, and Washington State. |
| | Metric 5: | Currency | Medium | Samples collected 2010-2012. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Participants in their first trimester recruited from California, Minnesota, New York, and Washington State during 2010-2012; single spot urines during first (70-100 samples per chemical) and third trimester period (n=679 samples); non-statistical sampling methodology. |
| | Metric 7: | Exposure Scenario | Medium | Participant characteristics described. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Most key criteria met; lack of raw data. |
| | Metric 9: | Quality Assurance | Medium | Quality assurance procedures briefly described, lack of pre-exposure/baseline samples, however analytic methodology referenced. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability described within statistical summary measures, potential study limitations described and comparisons with previous literature presented. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Shin, H. M., Bennett, D. H., Barkoski, J., Ye, X., Calafat, A. M., Tancredi, D., Hertz-Picciotto, I. (2019). Variability of urinary concentrations of phthalate metabolites during pregnancy in first morning voids and pooled samples. Environment International 122:222-230. |
| **HERO ID:** | 5043463 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling methodology does not represent best protocols. Participants were instructed to collect urine "in a clean plastic container," transfer into a study-provided bottle, then stored in their home refrigerator "or other cool place" for an unspecified amount of time. Additionally, many participants did not include all four requested samples (three first morning voids and one 24-hour) and the selection of samples to analyze from the provided number is unclear. |
| | Metric 2: | Analytical Methodology | High | Samples were analyzed at a CDC laboratory following methodology that is well-established and reliable. Analyte LOD is provided. |
| | Metric 3: | Biomarker Selection | Low | Two monoester phthalates are derived from the parent molecule of interest, one of which is derived from multiple parent molecules, and there is no stated method to quantify exposure for the molecule of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | California |
| | Metric 5: | Currency | Medium | 2007-2014 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 178 mothers (188 pregnancies) were instructed to provided four urine samples each: first morning void urine samples once per week for three weeks, and one 24-hour urine sample on the fourth week. However, many participants did not provide all requested samples; the selection of samples to analyze from the provided number favored first-morning voids and is otherwise unclear. |
| | Metric 7: | Exposure Scenario | Medium | Biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics for analyte concentration include 5th, 25th, 50th, 75th, and 95th percentile, as well as maximum and geometric mean. Individual concentration values are not reported. |
| | Metric 9: | Quality Assurance | High | Samples were analyzed at a CDC laboratory following protocols that are well-established to be precise and reproducible, including in-study assurances. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability between sample types (pooled vs. individual) and across trimesters is thoroughly discussed and analyzed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Al Qasmi, N. N., Al-Thaiban, H., Helaleh, M. I. H. (2019). Indoor phthalates from household dust in Qatar: Implications for non-dietary human exposure. Environmental Science and Pollution Research 26(1):421-430. |
| **HERO ID:** | 5043469 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology described. |
| | Metric 2: | Analytical Methodology | High | Analytical methodology described, LOD reported. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Qatar |
| | Metric 5: | Currency | Medium | Data collected in 2014 and 2015. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Replicate samples not collected. |
| | Metric 7: | Exposure Scenario | Medium | Indoor dust samples in 11 homes. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported. |
| | Metric 9: | Quality Assurance | High | Reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Some gaps and limitations provided. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Assens, M., Frederiksen, H., Petersen, J. H., Larsen, T., Skakkebæk, N. E., Juul, A., Andersson, A. M., Main, K. M. (2019). Variations in repeated serum concentrations of UV filters, phthalates, phenols and parabens during pregnancy. Environment International 123:318-324. |
| **HERO ID:** | 5043499 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling methodology is only briefly discussed, therefore, most sampling information is missing and likely to have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | High | Analytical instrumentation and methods are described in sufficient detail and are referenced to other published studies. LOD is reported for each analyte. |
| | Metric 3: | Biomarker Selection | High | The monoester phthalate biomarker is a metabolite of just the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Copenhagen, Denmark |
| | Metric 5: | Currency | Low | 1999-2001 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Blood serum samples from 128 pregnant women taken at various stages of pregnancy; 119 had samples from 4 timepoints. |
| | Metric 7: | Exposure Scenario | Medium | Phthalate metabolites were measured from prenatal serum of pregnant women. However, it is uncertain what the exposure sources are. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data are not reported; summary statistics include the detection rate, maximum, and percentiles (10, 25, 50, 75, 90) of concentration of metabolite. |
| | Metric 9: | Quality Assurance | Medium | QA/QC measures were briefly described and referenced to other published studies, but the results of these measures are not explicitly reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Characterization of variability is reported, and within-person and across-person variation are thoroughly investigated. However, discussion of methodological limitations or sources of uncertainty is absent. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Sulentic, R. O., Dumitrascu, I., Deziel, N. C., Gurzau, A. E. (2018). Phthalate Exposure from Drinking Water in Romanian Adolescents. International Journal of Environmental Research and Public Health 15(10):2109. |
| **HERO ID:** | 5043505 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methods described, including sample procedures, storage, and equipment for tap water, representative bottled water, and first morning urine samples. |
| | Metric 2: | Analytical Methodology | Medium | Analytic methodology described, including detection limits, analytical instrumentation, and extraction. Tap and bottled water samples analyzed according to ISO 18856, 2006 method. Urine specimens analyzed according to modified (unclear what was modified) Kim (2014) referenced study methods, along with creatinine analyses. |
| | Metric 3: | Biomarker Selection | High | Sampling for metabolites specific for parent chemical of interest in urine and measured the parent chemical in water. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples provided by participants in Cluj-Napoca, Romania. |
| | Metric 5: | Currency | High | Samples collected during the summer months of June and July of 2017. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Single first morning urine samples (not 24-hour samples) collected for 40 participants during a single season (summer) of a single year (2017). Only 10 tap water samples collected for 40 participants, and 16 bottled water concentrations reported. No replicates reported. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring (urine) study where exposure was assessed through sampling of tap and bottled water. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics included median, 25th and 75th percentiles. Raw data not provided. |
| | Metric 9: | Quality Assurance | Medium | Quality assurance procedures described, including blank and a laboratory control. No discussion of recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Characterized variability through tap and bottled water concentrations. Urinary concentrations reported across water consumption behaviors, consumer product use and demographics, as well as sample storage conditions. Potential study limitations and variability in results compared with previously reported studies presented. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Sun, J., Pan, L., Li, Z., Zeng, Q., Wang, L., Zhu, L. (2018). Comparison of greenhouse and open field cultivations across China: Soil characteristics, contamination and microbial diversity. Environmental Pollution 243(Pt B):1509-1516. |
| **HERO ID:** | 5043507 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology discussed, including study site characteristics, storage conditions, and sampling equipment. |
| | Metric 2: | Analytical Methodology | Low | Analytical methods reported, including extraction method, instrumentation, and recovery samples. Detection limits not provided. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in soil. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected from 20 provinces in China (figure 1). |
| | Metric 5: | Currency | High | Samples collected from 2014 to 2015. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 51 pairs (greenhouses and nearby open vegetable fields) of surface soils samples collected from 20 areas. 2 or 3 sites for each province. Replicate samples not indicated. |
| | Metric 7: | Exposure Scenario | Medium | Samples collected from greenhouse and surrounding open fields. Type of fertilizer used identified. No further information provided. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Critically Deficient | No stats provided specific for this chemical. Raw data not provided. |
| | Metric 9: | Quality Assurance | High | QC discussed including blanks, controls, and recoveries (Text S2). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Few gaps and limitations reported. Compared results to previous studies. |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Cheng, Z., Liu, J. B., Gao, M., Shi, G. Z., Fu, X. J., Cai, P., Lv, Y. F., Guo, Z. B., Shan, C. Q., Yang, Z. B., Xu, X. X., Xian, J. R., Yang, Y. X., Li, K. B., Nie, X. P. (2019). Occurrence and distribution of phthalate esters in freshwater aquaculture fish ponds in Pearl River Delta, China. Environmental Pollution 245:883-888. |
| **HERO ID:** | 5043518 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The study reported most necessary sampling methods including sample collection and storage methods. |
| | Metric 2: | Analytical Methodology | High | Methodology described in detail and includes extraction method, analytical instrumentation, recoveries, and LOD & LOQ. |
| | Metric 3: | Biomarker Selection | N/A | This metric is not applicable to the data source. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | This study was conducted in the Pearl River Delta, China. |
| | Metric 5: | Currency | High | The samples were collected between July 2016 and September 2017. |
| | Metric 6: | Spatial and Temporal Variability | High | At least 5 replicate samples were collected at each of 22 aquaculture fish ponds. |
| | Metric 7: | Exposure Scenario | Medium | The study is not able to make explicit links between sources of exposure and chemical concentrations. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. Mean concentrations were reported. |
| | Metric 9: | Quality Assurance | High | The study authors reported all key QA. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | The study authors reported few gaps, limitations, and uncertainties. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Kweon, D., Kim, M. K., Zoh, K. (2018). Distribution of brominated flame retardants and phthalate esters in house dust in Korea. Environmental Engineering Research 23(4):354-363. |
| **HERO ID:** | 5043550 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | QC: sampling methodology well described table 1 |
| | Metric 2: | Analytical Methodology | Medium | Some analytical methods not reported, such as recovery samples |
| | Metric 3: | Biomarker Selection | N/A | QC: indoor dust media |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | QC: Korea |
| | Metric 5: | Currency | Medium | Data collected in 2011 |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicates collected |
| | Metric 7: | Exposure Scenario | High | QC: indoor dust is relevant scenario for phthalates/frs |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data reported |
| | Metric 9: | Quality Assurance | High | QC: detailed QA/QC provided for calibration and recoveries in supplementary materials |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | No gaps nor limitations reported |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Lee, Y. M., Lee, J. E., Choe, W., Kim, T., Lee, J. Y., Kho, Y., Choi, K., Zoh, K. D. (2019). Distribution of phthalate esters in air, water, sediments, and fish in the Asan Lake of Korea. Environment International 126:635-643. |
| **HERO ID:** | 5043593 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology discussed including study area, sampling procedures and equipment, as well as storage conditions. |
| | Metric 2: | Analytical Methodology | High | Analytical methodology discussed, including extraction methods, instrumentation, and LOD and LOQ provided in SI. |
| | Metric 3: | Biomarker Selection | N/A | Measured parent chemical in air, water, sediment and fish. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected from Asan Lake, Korea. |
| | Metric 5: | Currency | High | Samples collected in 2016 and 2017. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Air samples collected from site A1 (n=4), water samples from sitesWS1–WS12 (n=47), sediment from sites WS1–WS12 (n=47), and fish samples near sites WS11 and W12 (n=30) at different seasons and spatial variation. No indication of replicate samples. |
| | Metric 7: | Exposure Scenario | High | Air, water, sediment, and fish collected from the largest artificial lake in Korea that is surrounded and likely affected by pollution from an industrial complex. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported. Statistics provided in Tables 1 and 2, including the mean, median, range, and detection frequency. |
| | Metric 9: | Quality Assurance | High | QA/QC described, including blanks and control samples as well as recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Seasonal and spatial variation discussed. Uncertainty only minimally discussed, no obvious concerns. |

## Overall Quality Determination High

**Study Citation:** van't Erve, T. J., Rosen, E. M., Barrett, E. S., Nguyen, R. H. N., Sathyanarayana, S., Milne, G. L., Calafat, A. M., Swan, S. H., Ferguson, K. K. (2019). Phthalates and phthalate alternatives have diverse associations with oxidative stress and inflammation in pregnant women. Environmental Science & Technology 53(6):3258-3267.

**HERO ID:** 5043603

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology was briefly described, except sample storage duration prior to analysis. Most key elements were outlined herein, with a more thorough discussion referenced in a separate paper. |
| | Metric 2: | Analytical Methodology | Medium | The analytical methodology was briefly described. Specific limits of detection appear in Table 3. There was no calibration or recovery data, but analytic methods were referenced, and there was a reference to quality control samples. |
| | Metric 3: | Biomarker Selection | Low | Sampling was for metabolites of phthalates. However, two metabolites could be derived from multiple parents (including one metabolite that could be derived from this chemical), and no effort was made to apportion them. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were provided by participants in California, Minnesota, New York, and Washington State. |
| | Metric 5: | Currency | Medium | Samples were collected in 2010-2012. |
| | Metric 6: | Spatial and Temporal Variability | Low | Participants in their first trimester recruited from California, Minnesota, New York, and Washington State during 2010-2012; single spot urines during third trimester period provided by n=762 participants. They used a non-statistical sampling methodology. There was no mention of replicates or duplicates. Rated low because they appeared to use un-pooled spot samples. |
| | Metric 7: | Exposure Scenario | Medium | Some participant characteristics were described, but they did not use a detailed questionnaire with information about potential sources of exposures. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not provided, but the mean, SD, and 25th/50th/765th/90th percentile result were included. This study measured certain biomarkers of oxidative stress alongside concentrations of phthalates. |
| | Metric 9: | Quality Assurance | Medium | The authors noted: "Quality control samples were analyzed with each batch with coefficients of variation within the expected range (CV = 3−7%)." Also, they corrected for urinary specific gravity. Other discussion of quality assurance procedures was missing, such as recoveries. No pre-exposure samples were available. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability was described using statistical data. Potential study limitations, including sources of uncertainty, were briefly described. |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | Ibeto, C., Anekwe, C., Ihedioha, J. (2019). Human exposure risk to semivolatile organic compounds via soil in automobile workshops in Awka, South Eastern, Nigeria. Environmental Science and Pollution Research 26(16):16249-16260. |
| **HERO ID:** | 5119775 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology reported, including sampling protocol, site, locations, sampling equipment, soil depth, and storage conditions. |
| | Metric 2: | Analytical Methodology | High | Analytical methodology discussed, including extraction method, analytical instrumentation, recovery, and detection limits (Table 4 footnote). For the analysis, EPA 8270 method was used. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical measured in soil samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected in Awka, South Eastern, Nigeria. |
| | Metric 5: | Currency | High | Samples collected in 2017. |
| | Metric 6: | Spatial and Temporal Variability | High | Samples in the dry and wet season across 10 different sampling sites. A total of 100 samples collected in total. Replicate samples collected. Control sample also collected from a farm land. |
| | Metric 7: | Exposure Scenario | High | The study sampled soil near 8 large automobile workshops as well as a control site from a farm land. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Individual sample concentrations were not reported. Mean concentrations and the standard deviations are reported. However ranges, frequency of detection were not reported. |
| | Metric 9: | Quality Assurance | High | The authors reported the results of the recovery experiments where all recoveries were above 85%. The study also collected and reported field control sample concentrations. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Authors did not discuss study limitations, data gaps, or uncertainties. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Berardi, C., Fibbi, D., Coppini, E., Renai, L., Caprini, C., Scordo, C. V. A., Checchini, L., Orlandini, S., Bruzzoniti, M. C., Del Bubba, M. (2019). Removal efficiency and mass balance of polycyclic aromatic hydrocarbons, phthalates, ethoxylated alkylphenols and alkylphenols in a mixed textile-domestic wastewater treatment plant. Science of the Total Environment 674(Elsevier):36-48. |
| **HERO ID:** | 5119787 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling and sampling equipment was described in detail with WWTP sampled during two weeks in summer using bottles and 24-h composite sampling using autosamplers. Samples were stored at 4C and analyzed within 48 hours and filtered. |
| | Metric 2: | Analytical Methodology | Low | Analytical methodology was described as utilizing EPA 3535A SPE method with GC-MS with recoveries noted and described within SI. Detection limits were not reported for this chemical in the main text, but may be within the SI. |
| | Metric 3: | Biomarker Selection | N/A | Sampling was conducted in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sampling was conducted in Prato, Italy. |
| | Metric 5: | Currency | Medium | Sampling was conducted in 2011. |
| | Metric 6: | Spatial and Temporal Variability | High | Seven samples were collected from one WWTP for each of two series for a total of n=14 samples during a 2 week period in summer. |
| | Metric 7: | Exposure Scenario | High | Concentrations in influent and effluent were sampled from a well-described WWTP area of an industrial textile district in Italy. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Influent and effluent mean relative percentages with standard deviations were depicted in Fig2b, however raw data is not reported. |
| | Metric 9: | Quality Assurance | Medium | Recovery range was provided in Section 2.4; Quality control was also implied via use of the EPA methods. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Standard deviations were reported in Figure 2B however study limitations were not discussed in detail. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Oros, D. R., Jarman, W. M., Lowe, T., David, N., Lowe, S., Davis, J. A. (2003). Surveillance for previously unmonitored organic contaminants in the San Francisco estuary. Marine Pollution Bulletin 46(9):1102-1110. |
| **HERO ID:** | 5162636 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling is discussed in section 2.1. |
| | Metric 2: | Analytical Methodology | Medium | method detection limit about 250 pg/l; concentrations blank corrected |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers were not assessed nor relevant to this study. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | San Francisco Estuary; different Bay regions |
| | Metric 5: | Currency | Low | 1999 and 2000 |
| | Metric 6: | Spatial and Temporal Variability | Critically Deficient | sample size not reported; samples collected were 100 l of water pumped at a flow rate of 1.5 l/min |
| | Metric 7: | Exposure Scenario | High | surface water |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | individual data points not reported; concentration by the different Bay regions provided; maximum concentration identified; not detected reported |
| | Metric 9: | Quality Assurance | Low | no QA section; samples were determined by comparingtheir response factors to those of the quantitationinternal standard |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability not discussed |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | He, R., Li, Y., Xiang, P., Li, C., Zhou, C., Zhang, S., Cui, X., Ma, L. Q. (2016). Organophosphorus flame retardants and phthalate esters in indoor dust from different microenvironments: Bioaccessibility and risk assessment. Chemosphere 150:528-535. |
| **HERO ID:** | 5163600 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling procedure, equipment, and sample storage details were reported. No calibration method was mentioned. |
| | Metric 2: | Analytical Methodology | High | The analytical methods were described. LOD was reported for each analyte. Recovery samples was used. |
| | Metric 3: | Biomarker Selection | N/A | The authors analyzed environmental samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Nanjing, China. |
| | Metric 5: | Currency | High | Sampling was conducted between January 2014 and March 2015. |
| | Metric 6: | Spatial and Temporal Variability | Low | n=33 samples in total. No replicate samples were mentioned. |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant exposure scenario related to flame retardants and phthalate esters in indoor dust from indoor spaces in Nanjing, China. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics were reported. Individual data points were not reported in the main article or in the SI. |
| | Metric 9: | Quality Assurance | Medium | QA/QC techniques were described but only mentioned procedural blanks, not field blanks. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability was characterized (range). Uncertainties were briefly described. |
| **Overall Quality Determination** | | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | Sun, H., An, T., Li, G., Qiao, M., Wei, D. (2014). Distribution, possible sources, and health risk assessment of SVOC pollution in small streams in Pearl River Delta, China. Environmental Science and Pollution Research 21(17):10083-10095. |
| **HERO ID:** | 5188487 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | clear and detailed sampling methods |
| | Metric 2: | Analytical Methodology | High | detailed methods, reported recoveries and LODs in supp. information |
| | Metric 3: | Biomarker Selection | N/A | Not a biomonitoring study |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Medium | Sampling began in 2008, ended in 2009 |
| | Metric 6: | Spatial and Temporal Variability | High | 2 samples per site, 6 sites, 2 seasons |
| | Metric 7: | Exposure Scenario | Medium | Data may represent a relevant exposure scenario. Authors acknowledge that residents wouldn't drink the water directly |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics, no raw data |
| | Metric 9: | Quality Assurance | High | detailed QA/QC, analyzed control samples, reported recoveries |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | limited characterization of uncertainties, study limitations and data gaps |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Purtymun, W. D., Ferenbaugh, R. W., Maes, M. (1988). Quality of surface and ground water at and adjacent to the Los Alamos National Laboratory: Reference organic compounds. |
| **HERO ID:** | 5255865 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology not described, but followed the USEPA guidelines USEPA 1983 and USEPA 1985. |
| | Metric 2: | Analytical Methodology | High | Analytical methods described in Appendix B. DL reported |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in an environmental media (water). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Geographic location is reported; Alamos National Laboratory, USA. |
| | Metric 5: | Currency | Low | Timing of sample collection for monitoring data is not consistent with current or recent exposures may be expected (> 15years). The water samples were collected in late September and early October of 1986. |
| | Metric 6: | Spatial and Temporal Variability | High | Sampling approach accurately captures variability. The study used a large sample size (43 surface and ground water stations and a total of 5,676 individual analytical results), and sampling occurred over a sufficient period of time (fall of one year). Replicate samples are used. |
| | Metric 7: | Exposure Scenario | High | Surface and ground water samples adjacent to the Los Alamos National Laboratory. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data (i.e., individual data points) are not reported , and therefore summary statistics cannot be reproduced. |
| | Metric 9: | Quality Assurance | Low | QA/QC describes in page 9 in QA/QC section. Recoveries are on the low side (<70%) and it is unclear if they correct for recovery. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability or uncertainty not reported. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Lee, S., Ahn, R. M., Kim, J. H., Han, Y. D., Lee, J. H., Son, B. S., Lee, K. (2019). Study design, rationale and procedures for human biomonitoring of hazardous chemicals from foods and cooking in Korea. International Journal of Environmental Research and Public Health 16(14):2583. |
| **HERO ID:** | 5386084 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported. |
| | Metric 3: | Biomarker Selection | High | Acceptable biomarker. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Korea |
| | Metric 5: | Currency | Low | Study conducted in 2009-2011. |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates. |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported. |
| | Metric 9: | Quality Assurance | High | Key QA reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Few limitations reported. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Giovanoulis, G., Nguyen, M. A., Arwidsson, M., Langer, S., Vestergren, R., Lagerqvist, A. (2019). Reduction of hazardous chemicals in Swedish preschool dust through article substitution actions. Environment International 130:104921. |
| **HERO ID:** | 5412073 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Reported key sampling details and cited sampling method previously were described in Papadopoulou et al., 2016 (reference not obtained). |
| | Metric 2: | Analytical Methodology | High | Extraction and analytical methods were well-described; collected replicate samples from each preschool; reported detection limits in Table 1; analyzed the standard reference material (SRM) 2585 (NIST, USA) each time in replicate (n=4) to evaluate accuracy of the analytical method. |
| | Metric 3: | Biomarker Selection | N/A | The analytes were collected as dust samples; biomarker samples were not collected. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The samples were collected in Stockholm area, Sweden. |
| | Metric 5: | Currency | High | Dust sampling took place from January to February 2018. |
| | Metric 6: | Spatial and Temporal Variability | High | The study had a sample size of n=20 and replicate samples from each pre-school. The study collected dust at one point in time (2018), but compared current dust contaminant concentrations to prior concentrations to examine the impact of implementation of "chemical smart" actions. |
| | Metric 7: | Exposure Scenario | High | The study collected questionnaire data during sampling to capture information on indoor materials, daily cleaning routines and ventilation function. It also examined association between dust and indoor parameters to understand product sources of exposure. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported in main text (does not seem to be reported in SI either, but SI file was not obtained). The standard deviation of summary statistics was not reported in main text. |
| | Metric 9: | Quality Assurance | High | The study analyzed solvent and field blanks. It reported adequate (>70%) sample recoveries; results were in good agreement with previously reported values in the literature. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | The study accounted for variability between chemicals and floor materials (boxplot distributions presented in Fig 1). It discussed key limitations and uncertainties, which likely underestimated risk to children specifically. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Sardiña, P., Leahy, P., Metzeling, L., Stevenson, G., Hinwood, A. (2019). Emerging and legacy contaminants across land-use gradients and the risk to aquatic ecosystems. Science of the Total Environment 695:133842. |
| **HERO ID:** | 5412432 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Detailed sampling methodology |
| | Metric 2: | Analytical Methodology | Medium | Reported LOD, limited information regarding recoveries |
| | Metric 3: | Biomarker Selection | N/A | Chemical samples were taken within environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Australia |
| | Metric 5: | Currency | High | Published in 2019 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 75 samples in total (water, sediment and soil) from 25 sites, no replicates |
| | Metric 7: | Exposure Scenario | Medium | Limited information about the population or scenario of interest |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics |
| | Metric 9: | Quality Assurance | Medium | Controls were analyzed. limited information on recoveries |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Provided detailed discussion of variability, uncertainties and study limitations |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Dodson, R. E., Bessonneau, V., Udesky, J. O., Nishioka, M., McCauley, M., Rudel, R. A. (2019). Passive indoor air sampling for consumer product chemicals: A field evaluation study. Journal of Exposure Science & Environmental Epidemiology 29(1):95-108. |
| **HERO ID:** | 5432871 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The air sampling methodology was well described and is scientifically sound |
| | Metric 2: | Analytical Methodology | High | The analytical methods were described, including LOD and recoveries. |
| | Metric 3: | Biomarker Selection | N/A | The authors analyzed air samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Data was collected in Boston, USA. |
| | Metric 5: | Currency | High | The samples were collected in Oct. 2013-July 2015. |
| | Metric 6: | Spatial and Temporal Variability | Low | n=37 samples, without replicates. |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant exposure scenarios related to consumer product chemicals in indoor air in Boston. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics were reported. Individual sample concentrations were not reported. |
| | Metric 9: | Quality Assurance | High | QA/QC techniques were described in detail, including the use of control samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability was characterized (range, 95th percentile). Uncertainties and study limitations were discussed in detail. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Lee, I., Kim, S., Park, S., Mok, S., Jeong, Y., Moon, H., Lee, J., Kim, S., Kim, H., Choi, G., Choi, S., Kim, S.,uY, Lee, A., Park, J., Choi, K. (2019). Association of urinary phthalate metabolites and phenolics with adipokines and insulin resistance related markers among women of reproductive age. Science of the Total Environment 688(Elsevier):1319-1326. |
| **HERO ID:** | 5433031 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sample storage conditions described, however duration of sample storage and most key sampling criteria not described. |
| | Metric 2: | Analytical Methodology | Medium | Most key criteria described, LOQ's reported as range; analytic methods referenced. |
| | Metric 3: | Biomarker Selection | Low | Sampling for metabolites not specific for parent chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples provided by participants in Seoul, Gyeonggi, Imcheon and Jeju, Republic of Korea. |
| | Metric 5: | Currency | High | Sample collection dates not reported, although can be inferred as recruitment 2015-2016 and publication date 2019. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Urine samples collected from n=459 participants selected for analytic sample after exclusions for study objectives and missing data from original n=516 women visiting health centers for regular checks and n=70 randomly chosen women participating in the CHECK study. Years of sample collection not reported. Non-statistical sampling methods. |
| | Metric 7: | Exposure Scenario | Medium | Participant characteristics summarized with respect to outcomes of interest. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Most key criteria met; lack of raw data. |
| | Metric 9: | Quality Assurance | Medium | Quality assurance procedures detailed, most key criteria met; lack of baseline pre-exposure sampling. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability characterized within summary statistics, potential study limitations discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Chakraborty, P., Sampath, S., Mukhopadhyay, M., Selvaraj, S., Bharat, G. K., Nizzetto, L. (2019). Baseline investigation on plasticizers, bisphenol A, polycyclic aromatic hydrocarbons and heavy metals in the surface soil of the informal electronic waste recycling workshops and nearby open dumpsites in Indian metropolitan cities. Environmental Pollution 248(Elsevier):1036-1045. |
| **HERO ID:** | 5433039 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Surface soil samples (0-20cm) were collected from 4 cities (Table S1 for site details) in India–Chennai, Kolkata, Mumbai and New Delhi. At each location, duplicate composite samples were collected. Samples were packed in aluminum foil and kept at -20C until extraction, however duration of sample storage was not detailed. Each sample was grinded and sieved. Soil sample collection details were provided in previous study (Chakraborty et al. 2018). |
| | Metric 2: | Analytical Methodology | High | The analytical methodology was described in terms of extraction, instrumentation (GC-MS), recoveries, calibration and limits of detection (Table S2). |
| | Metric 3: | Biomarker Selection | N/A | Chemicals were measured within environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Surface soil sampling was conducted within 4 cities in India–New Delhi (north), Kolkata (east), Mumbai (west) and Chennai (south). |
| | Metric 5: | Currency | Medium | Sampling was conducted in 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Duplicate composite surface (0-20 cm) soil samples were obtained from each sampling location during 2014. A total of 28 composite soil samples were obtained from informal e-waste recycling sites (3 subsites), dumpsites and control sites within each city (e-waste dismantling (EWD, n = 5), shredding (EWS, n = 4), precious metal recovery (EWR, n = 5), nearby open municipal dumpsites (DS, n = 11) and control sites (CS, n =3). |
| | Metric 7: | Exposure Scenario | High | This study measured the concentration in surface soil of informal e-waste recycling workshops and nearby open dumpsites and a control site in four metropolitan cities of India. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 1 provides the range, mean, and SD by e-waste site type and dumpsite. Raw data and detection frequencies were not provided. |
| | Metric 9: | Quality Assurance | Medium | QA/QC details were noted. Recovery rates ranged from 81-105%, and blank samples showed no sign of contamination. Pre-exposure control sampling was not conducted. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability in terms of standard deviation and range was detailed. Limitations were discussed within comparisons of results by site type/city and to results from previous studies, although a robust discussion of study limitations was lacking. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Ko, N. Y., Lo, Y. C., Huang, P. C., Huang, Y. C., Chang, J. L., Huang, H. B. (2019). Changes in insulin resistance mediate the associations between phthalate exposure and metabolic syndrome. Environmental Research 175:434-441. |
| **HERO ID:** | 5433079 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology is described in sufficient detail and in reference to a previous study, but certain aspects (e.g. duration of storage) are absent that are unlikely to have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | Low | Analytical instrumentation and methods are described in sufficient detail and are scientifically sound. LOD is reported in reference to a previous study and not provided here. |
| | Metric 3: | Biomarker Selection | High | MBzP is specific to BBzP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted in Taiwan. |
| | Metric 5: | Currency | High | Participants were recruited in June-August 2017. |
| | Metric 6: | Spatial and Temporal Variability | Low | Participants provided only a spot urine sample in the morning. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. Summary statistics include detection rate, maximum, and percentiles (25, 50, 95) of concentration across all participants and stratified by sex. |
| | Metric 9: | Quality Assurance | High | QA/QC measures included the use of blanks, replicates, and spiked samples; relative percent difference for replicates and spike recovery rates were within acceptable ranges. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Characterization of variability is reported by way of different percentiles of concentration. Limitations and sources of uncertainty are discussed, including only analyzing one sample per participant and possible lack of generalizability of results. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Zhang, Z. M., Zhang, H. H., Zou, Y. W., Yang, G. P. (2018). Distribution and ecotoxicological state of phthalate esters in the sea-surface microlayer, seawater and sediment of the Bohai Sea and the Yellow Sea. Environmental Pollution 240:235-247. |
| **HERO ID:** | 5433212 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The water and sediment sampling methodology is well described. |
| | Metric 2: | Analytical Methodology | High | The analytical methods were described, including LOD and recoveries. |
| | Metric 3: | Biomarker Selection | N/A | The authors analyzed environmental samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Bohai Sea and Yellow Sea. Specific sampling locations given. |
| | Metric 5: | Currency | Medium | The samples were collected in 2014. |
| | Metric 6: | Spatial and Temporal Variability | High | n=110 water samples, n=38 sediment samples. |
| | Metric 7: | Exposure Scenario | Medium | The data likely represent a relevant exposure scenario related to phthalate contamination of seawater and sediment in the Bohai and Yellow Seas. Population data or descriptions were not reported. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only raw data was reported. |
| | Metric 9: | Quality Assurance | High | QA/QC methods were described in detail. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability was not characterized. Uncertainties were briefly discussed. |

## Overall Quality Determination High

**Study Citation:** Zhang, Z., Zhang, C., Huang, Z., Yi, X., Zeng, H., Zhang, M., Huang, M. (2019). Residue levels and spatial distribution of phthalate acid esters in water and sediment from urban lakes of Guangzhou, China. Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 54(2):127-135.

**HERO ID:** 5433252

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Samples were collected from 8 urban lakes at 23 sites (Fig 1). Water was collected from surface to a depth of 50cm with a portable water sampler and stored in glass bottles at 4C. Sediment was collected below water interfaces within 10cm with stainless-steel grab sampler and PP bags to store at -80C and processed through freeze-drying. |
| | Metric 2: | Analytical Methodology | Medium | Authors reported using liquid-liquid extraction for water and ultrasonic extraction for sediments, followed by GC-MS for analysis. Recoveries were reported. LOQ only reported as a range for all phthalates combined (0.60-0.80 ng/L for water and 0.05-0.08 ng/g for sediment). |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in surface water and sediment. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected from Guangzhou, Southern China. |
| | Metric 5: | Currency | High | Samples were collected in 2016. |
| | Metric 6: | Spatial and Temporal Variability | High | Samples were collected from 8 urban lakes (23 water and 16 sediment samples from 23 sampling sites) during the dry season in October. No replicates were reported. |
| | Metric 7: | Exposure Scenario | High | Possible exposure to phthalates from surface water and sediments of eight lakes in an area of industrial activity is relevant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 1 provides mean, range and DF in water and sediment samples; Fig 2 depicts the distribution (concentrations) in water and sediment at each sampling site. No raw data were available. |
| | Metric 9: | Quality Assurance | High | Average recovery in water and sediments ranged from 76.9-110.3% and 77.6-107.8%, respectively. Blanks, spiked samples, and other QA/QC protocols were reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | There was no discussion of limitations, gaps, and uncertainties. Variance was characterized by min and max values. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Zhang, Z. M., Zhang, H. H., Zhang, J., Wang, Q. W., Yang, G. P. (2018). Occurrence, distribution, and ecological risks of phthalate esters in the seawater and sediment of Changjiang River Estuary and its adjacent area. Science of the Total Environment 619-620:93-102. |
| **HERO ID:** | 5433253 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology is detailed and complete with information on components such as site characteristics, collection regimen, and equipment. |
| | Metric 2: | Analytical Methodology | Medium | Extraction and analytical methods were reported, including references to previously published protocols for additional details. Recoveries and MDLs were also reported, but the latter only provided a range for all phthalates combined. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in water and sediment. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted in China. |
| | Metric 5: | Currency | High | Samples were collected in 2015. |
| | Metric 6: | Spatial and Temporal Variability | Medium | A total of 133 water samples (79 surface water and 54 seawater) and 17 sediment samples were collected without replicates. |
| | Metric 7: | Exposure Scenario | Medium | Data are likely to represent a relevant exposure scenario with the study area being part of a large economic center. However, details on the population of interest were missing. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual sample concentrations are provided in Tables S3 and S5. Most summary statistics are missing. |
| | Metric 9: | Quality Assurance | Medium | Authors analyzed control samples and referenced another study for more details. Recoveries were reported as a range, but the lower bound is <70%. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | A discussion of key uncertainties and limitations was absent. The first paragraph of Results provides some limited characterization of variance, but raw data are available. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Wu, Y., Sun, J., Zheng, C., Zhang, X., Zhang, A., Qi, H. (2019). Phthalate pollution driven by the industrial plastics market: a case study of the plastic market in Yuyao City, China. Environmental Science and Pollution Research 26(11):11224-11233. |
| **HERO ID:** | 5433502 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology discussed, including location of sites, sampling equipment, number of samples per media, and storage conditions. |
| | Metric 2: | Analytical Methodology | High | Key analytical methodology discussed, including extraction method, analytical instrumentation, recovery samples, and detection limits (Table S2) per media. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in soil, vegetables, and sediment. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected from sites downwind of the plastic market in Yuyao City, China. |
| | Metric 5: | Currency | High | Samples collected in 2017. |
| | Metric 6: | Spatial and Temporal Variability | High | Twenty-one soil samples, 21 vegetable samples, and 16 sedimentsamples were collected downwind of the market. |
| | Metric 7: | Exposure Scenario | High | Soil, vegetable, and sediment samples collected downwind of a plastic market in China. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. Several summary statistics were reported, including geometric mean, median, and range. |
| | Metric 9: | Quality Assurance | High | Key QA reported, including the use of blanks and recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | There is discussion of variability from the different sampling sites and distance from the market. Gaps and limitations not well characterized |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Guimaraes, W. B. (1995). Water quality in the Withers Swash Basin, with emphasis on enteric bacteria, Myrtle Beach, South Carolina, 1991-93. :1-102. |
| **HERO ID:** | 5438210 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | The water sampling methods were discussed but didn't include procedure details. The authors cited previously published articles. |
| | Metric 2: | Analytical Methodology | Medium | The analytical methods were reported, including instrumentation, LOD but did not include recoveries. |
| | Metric 3: | Biomarker Selection | N/A | The authors analyzed water samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in South Carolina, USA. |
| | Metric 5: | Currency | Low | The samples were taken in 1991 and 1992. |
| | Metric 6: | Spatial and Temporal Variability | High | n≥ 10 samples for a single scenario. The sample size was not explicitly reported but the results throughout the report suggest a large sample collection from 51 sites in total. |
| | Metric 7: | Exposure Scenario | Medium | The data likely represent relevant exposure scenarios related to water contamination in Withers Swash and its two tributaries in Myrtle Beach, S.C, USA. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics were reported (median, min, max). |
| | Metric 9: | Quality Assurance | Low | QA/QC techniques were not discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The authors provided a limited characterization of variability (range). Uncertainties and limitations were not discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Heck, B. A., Myers, N. C., Hargadine, D. A. (1992). Hydrogeology and ground-water quality conditions at the Reno County Landfill, South-Central Kansas, 1990-91. |
| **HERO ID:** | 5438509 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some sampling methods not reported such as sampler calibration |
| | Metric 2: | Analytical Methodology | Low | LOD nor LOQ reported |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Reno County, Kansas |
| | Metric 5: | Currency | Low | Data collected in 1991 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized. Further investigation needed to determine usefulness of information. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Raw data reported. Most summary statistics provided. |
| | Metric 9: | Quality Assurance | Low | Limited QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Wu, J., Ma, T., Zhou, Z., Yu, N.,a, He, Z., Li, B., Shi, Y., Ma, D. (2019). Occurrence and fate of phthalate esters in wastewater treatment plants in Qingdao, China. Human and Ecological Risk Assessment 25(6):1547-1563. |
| **HERO ID:** | 5442818 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling methodology only briefly described, including sampling equipment, storage conditions, and study site characteristics. However, sampling procedure not discussed, especially for influent and effluent. |
| | Metric 2: | Analytical Methodology | Low | Analytical methodology discussed including extraction methodology, analytical equipment, and recovery samples. Detection limits not provided. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in WWTP influent, effluent, and sludge. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected from WWTPs in Qingdao, China. |
| | Metric 5: | Currency | Medium | Samples collected in April 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | A total of 57 sewage and 9 sludge samples collected from 3 WWTPs. Number of influent, effluent, and samples within the each WWTPs not provided. |
| | Metric 7: | Exposure Scenario | High | Type of sewage each WWTP treats is described as well as each treatment process. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Raw data not reported. Table 1 provides summary statistics for influent from the three WWTPs. Table 2 provides mean of influent and effluent per WWTP and Table 3 statistics for sludge per WWTP. Number of samples per data set not clearly defined. |
| | Metric 9: | Quality Assurance | High | Key QA reported including use of blanks and recoveries (ranging from 78.5% to 109%). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Gaps and limitations were not reported. There was only a minimal characterization of variance. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Bigsby, P. R., Myers, N. C. (1989). Hydrogeology and ground-water-quality conditions at the Geary County landfill, northeast Kansas, 1988. |
| **HERO ID:** | 5449639 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | USGS conducted study; 7 monitoring wells sampled (MW- to MW-2); samples retrieved with a Teflon-bottom check-valve bailer and immediately put on ice; samples filtered; also samples of Smoky Hill River collected by dipping bottles into the stream and allowing to fill |
| | Metric 2: | Analytical Methodology | Low | Performed by Kansas Department of Health and Environment laboratory, no discussion of analytical methodology. Although missing analytical description and other QA and uncertainties in this report they have references in which this information can be found. Most of the used methodology are accepted methods performed by accredited labs. |
| | Metric 3: | Biomarker Selection | N/A | NA - water samples no biomarker needed. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Geary County, northeast Kansas |
| | Metric 5: | Currency | Low | Sept 20-22, 1988 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 7 wells sampled Sept 20-22; also 3 samples from the river; no replicate samples indicated |
| | Metric 7: | Exposure Scenario | High | groundwater quality conditions at a county landfill |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Table 8 provides concentration per site |
| | Metric 9: | Quality Assurance | Low | QA/QC not reported but implied as it is a USGS investigation |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | no discussion of variability or uncertainty |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Westinghouse Savannah River Company, (1993). Mixed Waste Management Facility (MWMF) groundwater monitoring report (U): Fourth quarter 1992 and 1992 summary. |
| **HERO ID:** | 5452031 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling methodology is only briefly discussed. Described sampling locations and study site characteristics. Did not report sample storage conditions/duration or sampling equipment and procedure. |
| | Metric 2: | Analytical Methodology | Critically Deficient | Analytical methodology is not described, including analytical instrumentation. |
| | Metric 3: | Biomarker Selection | N/A | Study tested for the parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Savannah River Site, Aiken, SC |
| | Metric 5: | Currency | Low | Samples collected throughout second quarter 1992. |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples were collected but there no replicate samples collected. Several wells sampled, but only one sample per well. |
| | Metric 7: | Exposure Scenario | Medium | The report provides extensive background information about the sites and wells. The data likely represent the relevant exposure scenario. Routes of exposure and populations of interest not described. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Raw data were reported. |
| | Metric 9: | Quality Assurance | Low | Quality assurance/quality control techniques and results were not discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | The characterization of variability is absent and key uncertainties, limitations, and data gaps are not discussed. |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Tahboub, Y. R., Zaater, M. F., Khater, D. F. (2017). Semi-volatile organic pollutants in Jordanian surface water. Arabian Journal of Chemistry 10:S3318-S3323. |
| **HERO ID:** | 5469387 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling was performed according to USEPA (1982) handbook for sampling and sample preservation of water and wastewater. details of the sampling method, sample storage, analytical method, and site characteristics were provided. |
| | Metric 2: | Analytical Methodology | Low | Thee analytical method, extraction and instrument were described in detail. LODs were not provided. |
| | Metric 3: | Biomarker Selection | N/A | Study tests chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The sampling locations in Jordan were described in detail. |
| | Metric 5: | Currency | Medium | The samples were collected in 2010. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Monthly samples from April to August 2010 were collected from 4 sites between April and August. |
| | Metric 7: | Exposure Scenario | High | The purpose of the study was to monitor reservoir water which is the main water source. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | The mean concentration and SD wre provided. Raw data were not provided. |
| | Metric 9: | Quality Assurance | Low | Quality assurance/quality control techniques and results were not directly discussed, but can be implied through the study's use of standard field and laboratory protocols. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Means and SDs were provided and there was limited discussion of uncertainty. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Luongo, G., Oestman, C. (2016). Organophosphate and phthalate esters in settled dust from apartment buildings in Stockholm. Indoor Air 26(3):414-425. |
| **HERO ID:** | 5469670 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling of indoor dust on tops of shelves and furniture as well as indoor air was described. Some criteria were not mentioned like sample storage conditions (may be listed in a referenced study, Bergh et al. (2010, 2011a,b, 2012)). |
| | Metric 2: | Analytical Methodology | Medium | Some analytic methodology criteria details were not mentioned, such as instrument calibration (but may be described in a referenced study). LOD's were reported. |
| | Metric 3: | Biomarker Selection | N/A | Sampling was conducted for parent chemicals of interest in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sampling was conducted in Stockholm, Sweden. |
| | Metric 5: | Currency | Medium | Data was collected in 2008. |
| | Metric 6: | Spatial and Temporal Variability | High | Indoor dust samples were collected in 2008 from 62 apartments in 19 different buildings in the Stockholm city area at a height of 0.8 meters from surfaces of furniture and frames of windows and doors. Indoor air sampling was conducted for 24-hours with duplicate active air samples positioned within a central location in each apartment on the same day as dust sampling. |
| | Metric 7: | Exposure Scenario | Medium | Source of exposure and population exposed were detailed. There were no exposure controls used. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Raw data was reported in Table S1. Some summary statistics included 25th percentile, median, 75th percentile, and range. Detection frequencies were reported. |
| | Metric 9: | Quality Assurance | High | QC details were described and included laboratory blanks. Standard reference materials were utilized for quality control samples. Baseline, pre-exposure sampling was not conducted. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | No limitations were described. Variations in toddler and adult exposure was studied. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Li, X., Liu, L., Wang, H., Zhang, X., Xiao, T., Shen, H. (2019). Phthalate exposure and cumulative risk in a Chinese newborn population. Environmental Science and Pollution Research 26(8):7763-7771. |
| **HERO ID:** | 5488911 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods (e.g., participant characteristics, study matrix, collection regimen, storage conditions) were reported. |
| | Metric 2: | Analytical Methodology | High | Extraction, analytical methods, and LODs were reported. |
| | Metric 3: | Biomarker Selection | High | MBzP is specific to BBzP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Participants were from Xiamen, China. |
| | Metric 5: | Currency | Medium | Samples were collected in 2012. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Urine samples were collected from 748 newborns without replicates. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study of newborns that were presumed to be exposed in utero. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. |
| | Metric 9: | Quality Assurance | High | QA/QC included replicate analysis, blanks, and compliance to the German External Quality Assessment Scheme for Biological Monitoring. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variance was characterized with SD. There was some but not a robust discussion of limitations. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Campbell, T. R. (1997). Soil, water, and streambed quality at a demolished asphalt plant, Fort Bragg, North Carolina, 1992-94. |
| **HERO ID:** | 5489294 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | samples were collected and handled according to procedures outlined in the work plan for Ft. Bragg SWMU's and approved by local government and EPA (p.17) |
| | Metric 2: | Analytical Methodology | High | samples were analyzed in accordance with the USEPA methods or ASTM standards; Table 4 provides LODs |
| | Metric 3: | Biomarker Selection | N/A | The authors analyzed environmental samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Ft. Bragg, Fayetteville, NC |
| | Metric 5: | Currency | Low | December 1992-April 1994 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 7 wells for groundwater sampling; 22 soil samples at various depths; several sub-samples of streambed sediment at various locations; soil samples collected at 7 locations across the site; |
| | Metric 7: | Exposure Scenario | Medium | soil, ground water, surface water, and sediments in the area of a demolished asphalt plant at Ft. Bragg; aim to determine if site should added to list of solid-waste management units under the RCRA permit; p. 12-16 contains information on the area of contamination |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 7 provides concentrations in soil samples; no results specific to this chemical; only data is for LOD |
| | Metric 9: | Quality Assurance | Low | QA/QC not directly discussed but implied through standard methods and lab protocols |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | characterization of variability and uncertainties are absent |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Al-Saleh, I., Elkhatib, R. (2014). Analysis of phthalates residues in apple juices produced in Saudi Arabia. Journal of Food Measurement and Characterization 8(4):373-380. |
| **HERO ID:** | 5489874 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methods were not thoroughly reported. Authors noted that they purchased seven brands of apple juice in local supermarkets, and no information was provided on selection criteria for these brands and supermarkets. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods, including extraction, instrumentation, and LOQs were reported. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in apple juice. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was performed in Saudi Arabia. |
| | Metric 5: | Currency | Low | Study was published in 2014. Sample collection date was not reported. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Seventy samples (7 brands, 10 batches per brand) were collected without replicates. |
| | Metric 7: | Exposure Scenario | High | Exposure to phthalates explained as the packaging, with both adults and child consumers as the population of interest. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. |
| | Metric 9: | Quality Assurance | High | QA/QC techniques was reported, including blank sampling, replicate analysis, spiking, and recoveries (within acceptable range). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Gaps and limitations were not characterized. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Chatonnet, P., Boutou, S., Plana, A. (2014). Contamination of wines and spirits by phthalates: Types of contaminants present, contamination sources and means of prevention. Food Additives & Contaminants: Part A, Chemistry, Analysis, Control, Exposure & Risk Assessment 31(9):1605-1615. |
| **HERO ID:** | 5490367 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | France |
| | Metric 5: | Currency | Medium | Study published in 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates. |
| | Metric 7: | Exposure Scenario | Medium | Exposure source characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported. |
| | Metric 9: | Quality Assurance | Low | Limited QA reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Shan, X. M., Wang, B. S., Lu, B. B., Shen, D. H. (2016). [Investigation of pollution of phthalate esters and bisphenols in source water and drinking water in Hefei City, China]. Huanjing yu Zhiye Yixue / Chinese Journal of Environmental & Occupational Medicine 33(4):350-355. |
| **HERO ID:** | 5491666 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling methods were described but barely. |
| | Metric 2: | Analytical Methodology | Low | The only description of analytical methods is as follows: sample preparation was solid phase extraction and determination by GS-MS. Detection limits were reported though. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in source and drinking water. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Hefei (China). |
| | Metric 5: | Currency | Medium | Samples were collected in 2012. |
| | Metric 6: | Spatial and Temporal Variability | High | There were 10 sampling sites where parallel samples were taken from each. |
| | Metric 7: | Exposure Scenario | High | The measurement of phthalates in source and drinking water is relevant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Mean concentrations and raw data are available in Table 1. |
| | Metric 9: | Quality Assurance | Low | Other than reporting recoveries (all >84%), no other QA/QC methods were discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Characterization of variance is missing, but raw data area available. There was no discussion of limitations, gaps, and uncertainties either. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Zimmermann, S., Gruber, L., Schlummer, M., Smolic, S., Fromme, H. (2012). Determination of phthalic acid diesters in human milk at low ppb levels. Food Additives & Contaminants: Part A, Chemistry, Analysis, Control, Exposure & Risk Assessment 29(11):1780. |
| **HERO ID:** | 5492285 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology briefly discussed. Authors cite previously published peer-review publication for more details. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported, including extraction method, instrumentation, and detection limits. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in human milk. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected from southern Germany. |
| | Metric 5: | Currency | Low | Study published in 2012. No date for research study provided. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 30 milk samples collected from 30 individuals. No replicate samples indicated. |
| | Metric 7: | Exposure Scenario | Medium | Sources of exposure not characterized, but the data represent a relevant general exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics provided, including number of samples below LOQ, max, median, and 95th percentile. Raw data reported |
| | Metric 9: | Quality Assurance | High | Key QA reported, including method blanks, standards, and recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability and uncertainty discussed, including discrepancies with other published studies and limitations with sample size. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Chen, C. F., Chen, C. W., Chen, T. M., Ju, Y. R., Chang, Y. K., Dong, C. D. (2017). Phthalate ester distributions and its potential-biodegradation microbes in the sediments of Kaohsiung Ocean Dredged Material Disposal Site, Taiwan. International Biodeterioration & Biodegradation 124:233-242. |
| **HERO ID:** | 5494792 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some sampling methods not reported, such as sampler calibration. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Taiwan |
| | Metric 5: | Currency | Medium | Samples collected in 2014. |
| | Metric 6: | Spatial and Temporal Variability | High | >10 samples collected; replicates. |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported. |
| | Metric 9: | Quality Assurance | Medium | QA conducted but reported in a different study. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Müller, J., Kördel, W. (1993). Occurrence and fate of phthalates in soil and plants. Science of the Total Environment 134(Suppl. 1):431-437. |
| **HERO ID:** | 5494794 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some sampling methods not reported such as sampler calibration and storage conditions |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported. LOD Reported |
| | Metric 3: | Biomarker Selection | N/A | testing for parent chemical |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | Critically Deficient | Geographic location is not referenced or reported |
| | Metric 5: | Currency | Low | Data collected from 1986 to 1989 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Three fields per phthalate emitting plant, 4 replicate samples at each field. |
| | Metric 7: | Exposure Scenario | Medium | Exposure scenario not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | few raw data points given |
| | Metric 9: | Quality Assurance | Low | No QA Reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps or limitations reported |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Guo, Y., Weck, J., Sundaram, R., Goldstone, A. E., Louis, G. B., Kannan, K. (2014). Urinary Concentrations of Phthalates in Couples Planning Pregnancy and Its Association with 8-Hydroxy-2'-deoxyguanosine, a Biomarker of Oxidative Stress: Longitudinal Investigation of Fertility and the Environment Study. Environmental Science & Technology 48(16):9804-9811. |
| **HERO ID:** | 5529569 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Some sampling methods were described, but reference to a previously published study was provided for more details. There was no information on when urine samples were collected by participants. |
| | Metric 2: | Analytical Methodology | Medium | Analytical methods were described, but LOQs was only reported as a range for all phthalates. |
| | Metric 3: | Biomarker Selection | High | MBzP is specific to BBzP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected in Michigan and Texas. |
| | Metric 5: | Currency | Medium | Samples collected during 2005-2009. |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicates were reported among the 849 urine samples. It is also unclear if the urine samples were spot or pooled. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study where exposure is presumed to occur through phthalates' ubiquity commercial and personal care products. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data were available. |
| | Metric 9: | Quality Assurance | High | QA/QC techniques were described, and samples were creatinine adjusted. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability was characterized. Uncertainties and limitations were not discussed |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Promtes, K., Kaewboonchoo, O., Kawai, T., Miyashita, K., Panyapinyopol, B., Kwonpongsagoon, S., Takemura, S. (2019). Human exposure to phthalates from house dust in Bangkok, Thailand. Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 11(13):7-Jan. |
| **HERO ID:** | 5532759 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sample methodology was succinctly summarized including a reference to previously published protocol for more details. |
| | Metric 2: | Analytical Methodology | High | Extract method, GC/MS, LOD, and recoveries were all reported. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in household dust. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected from homes in Bangkok, Thailand. |
| | Metric 5: | Currency | High | Samples were collected in 2017. |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicate samples were collected. |
| | Metric 7: | Exposure Scenario | High | Exposure to phthalates via household dust is relevant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data were reported. |
| | Metric 9: | Quality Assurance | Medium | There is some discussion of QA/QC with spiked samples, triplicate measurements, and recoveries (acceptable). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variance was characterized with a range. Discussion of limitations was very brief. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Hammel, S. C., Levasseur, J. L., Hoffman, K., Phillips, A. L., Lorenzo, A. M., Calafat, A. M., Webster, T. F., Stapleton, H. M. (2019). Children's exposure to phthalates and non-phthalate plasticizers in the home: The TESIE study. Environment International 132:105061. |
| **HERO ID:** | 5532853 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology is described for all sample media |
| | Metric 2: | Analytical Methodology | High | Analytical methodology is described and MDL reported per metabolite in table 2 |
| | Metric 3: | Biomarker Selection | High | MBzP urine, BBP in dust and handwipes |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | USA NC |
| | Metric 5: | Currency | High | 2014-2016 |
| | Metric 6: | Spatial and Temporal Variability | Medium | No sample replicates, 203 children from 190 families |
| | Metric 7: | Exposure Scenario | High | Biomonitoring children exposure to phthalates |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data. Table 2 Descriptive statistics for phthalates and non-phthalate plasticizers with their urinary metabolites |
| | Metric 9: | Quality Assurance | High | Recovery, field blanks, NIST samples for accuracy |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | No standard difference reported. Section 3.5 limitations |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Garí, M., Koch, H. M., Pälmke, C., Jankowska, A., Wesołowska, E., Hanke, W., Nowak, D., Bose-O'Reilly, S., Polańska, K. (2019). Determinants of phthalate exposure and risk assessment in children from Poland. Environment International 127:742-753. |
| **HERO ID:** | 5540505 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | The cohort methodology have been published previously (Polańska et al., 2009, 2011, 2016a). |
| | Metric 2: | Analytical Methodology | High | LOD reported in table 2. Samples were analyzed in the spot urine samples using high performance liquid chromatography coupled with tandem mass spectrometry (HPLC-MS/MS) method. |
| | Metric 3: | Biomarker Selection | High | Urine MBzP |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Poland |
| | Metric 5: | Currency | High | 2014-2015 |
| | Metric 6: | Spatial and Temporal Variability | Medium | No sample replicates, n=250 samples. |
| | Metric 7: | Exposure Scenario | High | Biomonitoring |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No individual data points. Table 2 Concentrations of phthalate metabolites in urine of seven year-old children (in$\mu$g/l) in the REPRO_PL cohort (n=250). |
| | Metric 9: | Quality Assurance | Medium | QC is mentioned but not reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Key limitation described, variability reported in table 2. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Li, K., Ma, D., Wu, J., Chai, C., Shi, Y. (2016). Distribution of phthalate esters in agricultural soil with plastic film mulching in Shandong Peninsula, East China. Chemosphere 164:314-321. |
| **HERO ID:** | 5540829 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology discussed, including sampling procedure, sample information, and storage conditions. |
| | Metric 2: | Analytical Methodology | Medium | Analytical methodology discussed, including extraction method, analytical instrumentation, and recovery samples. However, MDL not reported for this chemical. Only a range is provided for PAEs. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in soil. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected from four areas (Qingdao, Weihai, Weifang, and Yantai) in Shandong Peninsula, East China. |
| | Metric 5: | Currency | Medium | Samples collected in 2012. |
| | Metric 6: | Spatial and Temporal Variability | High | A total of 108 samples collected from 36 vegetable fields, in 4 areas (Qingdao samples: 30, Yantai samples: 30, Weifang samples: 24, and Weihai samples: 24). |
| | Metric 7: | Exposure Scenario | High | Samples collected from soils with plastic film mulching in vegetable fields in China. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 2 provides summary statistics for all the agricultural soils, including range, mean, std, and detection frequency. Raw data not reported. |
| | Metric 9: | Quality Assurance | High | Key QA reported, including use of blanks, standards, and recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability between the four study areas as well as depth of soil discussed and presented in Figs 2 and 3. Gaps and limitations not well characterized. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Schecter, A., Lorber, M., Guo, Y., Wu, Q., Yun, S. H., Kannan, K., Hommel, M., Imran, N., Hynan, L. S., Cheng, D., Colacino, J. A., Birnbaum, L. S. (2013). Phthalate concentrations and dietary exposure from food purchased in New York State. Environmental Health Perspectives 121(4):473-494. |
| **HERO ID:** | 5540861 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Description of sampling methodology is limited, but most criteria are not applicable given it mostly involved purchasing food samples. |
| | Metric 2: | Analytical Methodology | High | Extraction and analytical methods described in detail for the various food types. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in food. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Food samples were purchased in New York. |
| | Metric 5: | Currency | Medium | Samples were collected in 2011. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 72 commonly consumed food samples were purchased without replicates. |
| | Metric 7: | Exposure Scenario | High | The potential exposure to phthalates via food is relevant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data may be reported in the supplementary materials, but cannot access them. |
| | Metric 9: | Quality Assurance | Medium | QA conducted (e.g., spiked blank, matrix, duplicate analysis), but reference to methods was provided and not described fully. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited characterization of variance. Some gaps and limitations were reported. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Wang, X., Lou, X., Zhang, N., Ding, G., Chen, Z., Xu, P., Wu, L., Cai, J., Han, J., Qiu, X. (2015). Phthalate esters in main source water and drinking water of Zhejiang Province (China): Distribution and health risks. Environmental Toxicology and Chemistry 34(10):2205-2212. |
| **HERO ID:** | 5540969 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Site description, collection timing, equipment, storage, and more were all reported. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods were reported. LODs/LOQs are in Table S2. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemical in source and drinking water. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected from Zhejiang, China. |
| | Metric 5: | Currency | Medium | Samples were collected in 2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Water was collected from 19 different sources without replicates. |
| | Metric 7: | Exposure Scenario | High | Exposure to phthalates via drinking water is relevant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. |
| | Metric 9: | Quality Assurance | High | Key QA/QC methods were reported, including recoveries which were acceptable. (Note that main text has a typo on reported recoveries. Refer to Table S2 for exact numbers). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Gaps and limitations were not described. |

## Overall Quality Determination High

**Study Citation:** Mouritsen, A., Frederiksen, H., Sørensen, K., Aksglaede, L., Hagen, C., Skakkebaek, N. E., Main, K. M., Andersson, A. M., Juul, A. (2013). Urinary phthalates from 168 girls and boys measured twice a year during a 5-year period: Associations with adrenal androgen levels and puberty. Journal of Clinical Endocrinology and Metabolism 98(9):3755-3764.

**HERO ID:** 5541110

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Population characteristics, sampling collection for first morning urine samples, storage condition, and sample preparation were described. |
| | Metric 2: | Analytical Methodology | High | LC-MS/MS was used for analysis. LOD was provided. |
| | Metric 3: | Biomarker Selection | High | Biomarker (MBzP) is derived from exposure to the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted in the Copenhagen area of Denmark. |
| | Metric 5: | Currency | Medium | The study was conducted during 2006-2010. |
| | Metric 6: | Spatial and Temporal Variability | Medium | A total number of 792 (boys and girls) urinary samples were presented in the supplementary table 1 without replicates. |
| | Metric 7: | Exposure Scenario | Medium | This is a biomonitoring study but there was no discussion about suspected sources of exposure, not even speaking generally from phathlates' ubiquity. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data were not reported. Mean concentrations and coefficient of variance were reported for each analyte in Table S1. |
| | Metric 9: | Quality Assurance | Medium | Quality assurance was reported to be conducted, though description was referred to elsewhere. Recoveries were all above 89%. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Limitations were described in the study, which were mainly on the variations in the volume, and time of collection of urinary samples. Variance characterized by range in Table S1. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Yuan, S. Y., Liu, C., Liao, C. S., Chang, B. V. (2002). Occurrence and microbial degradation of phthalate esters in Taiwan river sediments. Chemosphere 49(10):1295-1299. |
| **HERO ID:** | 5541359 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Methodology was succinct but complete. |
| | Metric 2: | Analytical Methodology | High | Extraction and analysis was performed according to USEPA SW-846 method 8270. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Taiwan. |
| | Metric 5: | Currency | Low | Sampling was conducted in 2000. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 14 river water and 6 sediment samples were collected without replicates. |
| | Metric 7: | Exposure Scenario | High | Samples collected from some of the most heavily contaminated in Taiwan where aquatic environments may be affected. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data were provided. |
| | Metric 9: | Quality Assurance | Low | Recoveries are acceptable but little reporting of QA/QC otherwise. It can be inferred that proper protocols were followed through the study's use of a standard method. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Key uncertainties, limitations, and data gaps were not discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Zhang, S. H., Guo, A. J., Fan, T. T., Zhang, R., Niu, Y. J. (2019). Phthalates in residential and agricultural soils from an electronic waste-polluted region in South China: distribution, compositional profile and sources. Environmental Science and Pollution Research 26(12):12227-12236. |
| **HERO ID:** | 5541389 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Key sampling methods reported |
| | Metric 2: | Analytical Methodology | Medium | Key analytical methods reported |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Residential and agricultural soils from Guiyu, Shantou, China. Maps were provided. |
| | Metric 5: | Currency | Medium | Samples collected in 2012 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure scenario not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported |
| | Metric 9: | Quality Assurance | High | Key QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Gaps and limitations not well characterized |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Weiss, J. M., Gustafsson, Å., Gerde, P., Bergman, Å., Lindh, C. H., Krais, A. M. (2018). Daily intake of phthalates, MEHP, and DINCH by ingestion and inhalation. Chemosphere 208:40-49. |
| **HERO ID:** | 5550408 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | The study authors reported some sampling methods. Some methods were not reported such as sample storage conditions. |
| | Metric 2: | Analytical Methodology | Medium | The study authors reported the LOD. Recovery samples were not reported. |
| | Metric 3: | Biomarker Selection | N/A | Study looked at chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in Sweden. |
| | Metric 5: | Currency | Low | The date of sample collection was not reported for pooled samples. Individual dust samples were part of 2012 MiSSE project. |
| | Metric 6: | Spatial and Temporal Variability | Medium | For pooled samples there were 61 samples collected in total but pooled across three locations. For individual samples there were 10 samples for living rooms and 5 samples for children's rooms. |
| | Metric 7: | Exposure Scenario | Medium | This was a monitoring study and did not examine specific sources of exposure. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Raw data were reported in the supplementary materials. |
| | Metric 9: | Quality Assurance | High | The study authors reported key QA. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | The study authors reported few gaps, limitations, and uncertainties. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Molbert, N., Alliot, F., Santos, R., Chevreuil, M., Mouchel, J. M., Goutte, A. (2019). Multiresidue Methods for the Determination of Organic Micropollutants and Their Metabolites in Fish Matrices. Environmental Toxicology and Chemistry 38(9):1866-1878. |
| **HERO ID:** | 5555943 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Key sampling methods reported |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported |
| | Metric 3: | Biomarker Selection | Medium | Acceptable biomarker |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | France |
| | Metric 5: | Currency | High | Samples collected in 2016 |
| | Metric 6: | Spatial and Temporal Variability | High | >5-10 samples; replicates of chub muscle and liver |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported |
| | Metric 9: | Quality Assurance | High | QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Lee, K. S., Lim, Y. H., Kim, K. N., Choi, Y. H., Hong, Y. C., Lee, N. (2018). Urinary phthalate metabolites concentrations and symptoms of depression in an elderly population. Science of the Total Environment 625:1191-1197. |
| **HERO ID:** | 5556125 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Recruitment details, including participant characteristics, were described. However, urine sample collection regimen was mostly absent. |
| | Metric 2: | Analytical Methodology | Low | LODs and creatinine-adjusted levels were provided. No other information regarding analytical methods were described except for a reference (Kim et al. 2009). |
| | Metric 3: | Biomarker Selection | Medium | MBzP is specific to DBzP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted in South Korea. |
| | Metric 5: | Currency | Medium | Samples were collected in 2012. |
| | Metric 6: | Spatial and Temporal Variability | Low | 535 participants provided a urine sample. No replicates were reported. No details about urine samples (e.g., pooled, first morning voids, spot) were provided. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study were exposure is presumed to occur through phthalates' ubiquity in the environment. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported |
| | Metric 9: | Quality Assurance | Low | QA/QC methods were mostly absent, except for adjusting for creatinine. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Some limitations reported in last paragraph of Discussion. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Fromme, H., Lahrz, T., Piloty, M., Gebhart, H., Oddoy, A., Rüden, H. (2004). Occurrence of phthalates and musk fragrances in indoor air and dust from apartments and kindergartens in Berlin (Germany). Indoor Air 14(3):188-195. |
| **HERO ID:** | 5556411 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Unclear how the sampled buildings were selected |
| | Metric 2: | Analytical Methodology | High | LODs provided (called "determination limits") Standard analytic methods. Blanks and recoveries meaured. |
| | Metric 3: | Biomarker Selection | N/A | NA since testing for parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Berlin, Germany |
| | Metric 5: | Currency | Low | 2000 to 2001 |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicates used. n = 59, 74, or 30 |
| | Metric 7: | Exposure Scenario | Medium | No info on chemical use inside building. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics but no raw data |
| | Metric 9: | Quality Assurance | Medium | Recovery rates and blanks were used. No detailed discussion of QA/QC |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Good discussion of uncertainty and variability in the estimated phthalate intake. No discussion of limitations of the concentration data. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Polyakova, O. V., Artaev, V. B., Lebedev, D. T. (2018). Priority and emerging pollutants in the Moscow rain. Science of the Total Environment 645:1126-1134. |
| **HERO ID:** | 5576453 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methods were described in detail. Sample preparation was carried out according to the US EPA 8270D Method. |
| | Metric 2: | Analytical Methodology | Low | Analytical methods were sufficiently described. LOD not reported. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical measured in rainwater. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected in Moscow. |
| | Metric 5: | Currency | High | The samples were collected in the period between April 7 and May 15, 2017. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 8 rain samples collected. No replicates mentioned. |
| | Metric 7: | Exposure Scenario | High | Ambient samples of rainwater collected in 2 locations in Moscow. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Raw data reported. |
| | Metric 9: | Quality Assurance | High | Key QA reported including use of blanks and recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No limitations or variability mentioned. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Lin, L., Dong, L., Meng, X., Li, Q., Huang, Z., Li, C., Li, R., Yang, W., Crittenden, J. (2018). Distribution and sources of polycyclic aromatic hydrocarbons and phthalic acid esters in water and surface sediment from the Three Gorges Reservoir. Journal of Environmental Sciences 69:271-280. |
| **HERO ID:** | 5576760 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | include map of sampling sites and describe overview of sampling procedure. Transport details missing. |
| | Metric 2: | Analytical Methodology | High | detailed description of analytical methods and provide detection limits. |
| | Metric 3: | Biomarker Selection | N/A | environmental media |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Three Gorges reservoir/Yangtze River |
| | Metric 5: | Currency | High | 2015 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 20 sample sites. No replicates collected. |
| | Metric 7: | Exposure Scenario | Medium | investigating plastics and pollutants in water sources |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | provide bar graph with error bars but all chemical concentrations are on the same graph/axis which is misleading; no raw data or detailed summary stats |
| | Metric 9: | Quality Assurance | Medium | included standards; all recoveries for water samples were >85%; sediment samples recoveries all >60% |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | no discussion of uncertainties and limited measures of variance |

## Overall Quality Determination Medium

**Study Citation:** Rodríguez-Ramos, R., Socas-Rodríguez, B., Santana-Mayor, Á., Rodríguez-Delgado, M. Á. (2019). Nanomaterials as alternative dispersants for the multiresidue analysis of phthalates in soil samples using matrix solid phase dispersion prior to ultra-high performance liquid chromatography tandem mass spectrometry. Chemosphere 236:124377.

**HERO ID:** 5617923

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Soil and sand samples were collected following the guidelines established by the Joint Research Centre of the European commission, which is a publicly available and scientifically sound SOP. |
| | Metric 2: | Analytical Methodology | High | Development of improved analytical methodology was the focus of this study. All important details are included and the methods are scientifically sound. LOQ were reported. |
| | Metric 3: | Biomarker Selection | N/A | This study was testing for the parent chemical of interest in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | This study used soil and sand samples collected in Tenerife (Canary Islands, Spain). |
| | Metric 5: | Currency | Low | Timing of sample collection was not reported, but a publication date is available. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Five soil samples and four sand samples were analyzed. One sample of each type was not a ”real” sample collected during the study. Use of replicates was not reported. |
| | Metric 7: | Exposure Scenario | High | Soil samples were collected from agricultural crop areas related to cereals and potatoes, and sand samples were from beaches. Both sample sets were well characterized and represent relevant exposure sources. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data are reported; results obtained as an average of two analyses for each sample. Summary statistics are not reported but not warranted for the size of the data set and contents of the data (i.e., most data points are not detected or below LOQ). |
| | Metric 9: | Quality Assurance | High | Development of improved analytical methodology was the focus of this study. An exhaustive validation of the whole methodology was carried out, obtaining good linearity as well as recovery values between 70 and 120% with RSDs below 20% for all analytes in the selected matrices. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Quantitative characterization of variability is not reported, but there is some qualitative discussion around variability and uncertainty. |
| **Overall Quality Determination** | | | **High** | |

| | |
|---|---|
| **Study Citation:** | Huang, C. N., Yee, H., Cho, H. B., Lee, C. W. (2019). Children's exposure to phthalates in dust and soil in Southern Taiwan: A study following the phthalate incident in 2011. Science of the Total Environment 696:133685. |
| **HERO ID:** | 5618703 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The dust and soil sampling methodologies were well described. |
| | Metric 2: | Analytical Methodology | High | The analytical methods were described in detail, including LODs and recoveries. |
| | Metric 3: | Biomarker Selection | N/A | The authors analyzed environmental samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Taiwan. |
| | Metric 5: | Currency | Medium | Samples were collected between 2012 and 2014. |
| | Metric 6: | Spatial and Temporal Variability | High | n>10 indoor and n>10 outdoor samples. |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant exposure scenarios related to phthalates in dust and soil in Taiwan. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics were reported. |
| | Metric 9: | Quality Assurance | Medium | QA/QC techniques were briefly described. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability was characterized (SD, range). Uncertainties were discussed. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Pereira, J., Selbourne, M. D., Pocas, F. (2019). Determination of phthalates in olive oil from European market. Food Control 98:54-60. |
| **HERO ID:** | 5619803 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected from markets from several European countries (Sweden, Spain, Portugal, Ireland, Italy, Luxemburg, Portugal). |
| | Metric 5: | Currency | Medium | Samples collected in 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates. |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Raw data reported in Figure 2. |
| | Metric 9: | Quality Assurance | Medium | Limited QA reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Kunikane, S., Ando, M., Aizawa, T., Kanegaki, Y. (2004). A nationwide survey of endocrine disrupting chemicals in source and drinking waters in Japan. Journal of Water and Environment Technology 2(1):17-22. |
| **HERO ID:** | 5628092 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Authors discussed little beyond site characteristics. |
| | Metric 2: | Analytical Methodology | Medium | Detection limits provided in Table 2. Authors cited the analytical methods that were prepared by the Environment Agency but little details beyond that. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in ground and surface water. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Japan. |
| | Metric 5: | Currency | Low | Samples were collected in 1999. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 45 samples were collected without replicates. |
| | Metric 7: | Exposure Scenario | Low | Most details are missing (e.g., exposure source, details, population of interest, microenvironment). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Raw data were not reported, and only detection frequency and range were reported. |
| | Metric 9: | Quality Assurance | Low | Authors did attempt to reduce analytical variations between samples by using the same laboratory. However, all other QA/QC protocols were missing. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variance was characterized by range. There was no discussion of uncertainty and study limitations. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Wang, X. T., Ma, L. L., Sun, Y. Z., Xu, X. B. (2006). Phthalate esters in sediments from Guanting Reservoir and the Yongding River, Beijing, People's Republic of China. Bulletin of Environmental Contamination and Toxicology 76(5):799-806. |
| **HERO ID:** | 5629322 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some methods not reported, such as sample storage conditions, equipment, and regimen. |
| | Metric 2: | Analytical Methodology | Medium | Extraction and analytical methods followed EPA's SW-846 and 8061A with modifications reported. MDLs were only reported as a range for all phthalates combined. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in surface water. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected from the Guanting Reservoir and Yongding River in China. |
| | Metric 5: | Currency | Low | Samples were collected in 2003. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Samples were collected from 12 sites with no report of replicates. |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not provided. |
| | Metric 9: | Quality Assurance | Low | QA/QC can be implied through its use of EPA protocols. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variance was characterized with range and SD, but there was no discussion of gaps and limitations. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Puklová, V., Janoš, T., Sochorová, L., Vavrouš, A., Vrbík, K., Fialová, A., Hanzlíková, L., Černá, M. (2019). Exposure to mixed phthalates in Czech preschool and school children. Archives of Environmental Contamination and Toxicology 77(4):9-Jan. |
| **HERO ID:** | 5630466 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Authors described study population, collection procedure, equipment, and storage. Note that some components of sampling methodology are not relevant to urine collection (e.g., sampler calibration). |
| | Metric 2: | Analytical Methodology | Medium | Some analytical methods were not reported such as recovery samples. |
| | Metric 3: | Biomarker Selection | High | MBzP is specific to BBzP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Czech Republic. |
| | Metric 5: | Currency | High | Samples were collected between 2016 and 2017. |
| | Metric 6: | Spatial and Temporal Variability | Medium | A total of 370 samples were collected without replicates and only first morning void. |
| | Metric 7: | Exposure Scenario | High | Children's exposure to the countless products containing phthalates, as measured in this biomonitoring study, is relevant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. |
| | Metric 9: | Quality Assurance | Low | QA/QC protocol was not reported but implied through its use of the National Institute of Public Health Laboratory in Prague. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variance characterized by range. Some gaps and limitations were reported. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Coiner, R. L., Pope, L. M., Mehl, H. E. (2010). Assessment of energetic compounds, semi-volatile organic compounds, and trace elements in streambed sediment and stream water from streams draining munitions firing points and impact areas, Fort Riley, Kansas, 2007-08. :55. |
| **HERO ID:** | 5676787 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | sediment and surface water sampling performed by USGS in cooperation with the US Army; sediment samples collected from top 2.0cm using stainless steel or plastic scoop and sieved onsite; freeze dried and placed in storage; water samples manually collected equal-width increment method and stored in glass jar; water processed unfiltered |
| | Metric 2: | Analytical Methodology | High | conducted by USACE contract laboratory according to USEPA Method 8330 for nitroaromatic and nitramine compounds, USEPA Method 8332 for nitroglycerin, USEPA Method 8321 (modified) for perchlorate, and USEPA Method 8270C/8270D for SVOCs (table 4) |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Fort Riley, northeast Kansas |
| | Metric 5: | Currency | Medium | June 2007-June 2008 |
| | Metric 6: | Spatial and Temporal Variability | High | 16 streambed sediment sampling sites and 5 stream-water sampling sites (17 samples collected during run-off); 3 streams water samples collected during base-flow conditions; replicate samples collected |
| | Metric 7: | Exposure Scenario | Medium | streambed sediment and stream water from streams draining munitions firing points and impact areas |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Table 15 and 16 provide raw data |
| | Metric 9: | Quality Assurance | High | QA discussed on p.13-16; QA measures part of lab analytical protocols |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | discussed variability (p.17 and 22) and uncertainty |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Saliu, F., Montano, S., Leoni, B., Lasagni, M., Galli, P. (2019). Microplastics as a threat to coral reef environments: Detection of phthalate esters in neuston and scleractinian corals from the Faafu Atoll, Maldives. Marine Pollution Bulletin 142(Elsevier):234-241. |
| **HERO ID:** | 5683148 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | A study area map was provided; sampling equipment, methods, storage, and containers were described in detail. |
| | Metric 2: | Analytical Methodology | Medium | LOD range provided; sample prep, extraction, LC-MS instrumentation, calibration, and methods described in detail. Analytical method for extracting chemicals from coral seems somewhat novel, but was described in a prior paper, as well. Method validation is not described herein. |
| | Metric 3: | Biomarker Selection | High | Parent and metabolite measured in coral and plankton. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Republic of Maldives |
| | Metric 5: | Currency | High | 2018 |
| | Metric 6: | Spatial and Temporal Variability | Medium | The narrative indicates there were 12 sampling sites, and 10 coral samples were collected per location, then homogenized for each location. 9 neuston-plankton samples were collected. Sampling characteristics are described in more detail in a separate paper. Table 4 shows 8 coral samples, not 12, for reasons that are not explained. Also, there were no replicates reported. |
| | Metric 7: | Exposure Scenario | Medium | Coral and neuston-plankton were analyzed for phthalates, and the amounts of microplastics in the neustonic water were also assessed. The total amount or nature of sources of microplastics is not discussed. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Tables 3 and 4 provide individual data points. Most summary statistics are absent. |
| | Metric 9: | Quality Assurance | High | QA was discussed, including matrix spikes, calibration verification, method blanks, spiked blanks, and recoveries (which were 93 $\pm$ 24%). No QA/QC issues identified. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability was discussed, and there was minimal discussion of sources of uncertainty. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Li, J., Xia, W., Wu, C., Zhao, H., Zhou, Y., Wei, J., Ji, F., Luan, H., Xu, S., Cai, Z. (2019). Variations of phthalate exposure and metabolism over three trimesters. Environmental Pollution 251(Elsevier):137-145. |
| **HERO ID:** | 5692137 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most key criteria were met. Specifics on equipment and duration of sample storage prior to analysis were lacking. |
| | Metric 2: | Analytical Methodology | Medium | Most key criteria met, including reference to previously published protocols. However, LODs were reported as a range. |
| | Metric 3: | Biomarker Selection | High | MBzP is specific to BBzP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples provided by participants in Wuhan City, China. |
| | Metric 5: | Currency | Medium | Samples collected 2014-2015. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Multiple samples provided by 946 participants over three trimesters of pregnancy for a total of n=2838 samples. Samples provided only by participants in one city. |
| | Metric 7: | Exposure Scenario | Medium | Participant characteristics reported in Table 1. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data were provided. |
| | Metric 9: | Quality Assurance | Medium | Some quality assurance procedures were reported, such as recovery which were acceptable and adjustments for urine dilution. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | There was no discussion of limitations, uncertainties. and gaps. |
| **Overall Quality Determination** | | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | Buckley, J. P., Engel, S. M., Mendez, M. A., Richardson, D. B., Daniels, J. L., Calafat, A. M., Wolff, M. S., Herring, A. H. (2016). Prenatal phthalate exposures and childhood fat mass in a New York City cohort. Environmental Health Perspectives 124(4):507-513. |
| **HERO ID:** | 5699787 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Limited description of sampling methods |
| | Metric 2: | Analytical Methodology | Medium | Authors did not described laboratory methods aside from citing previously reported methods. LODs reported in Table 2. |
| | Metric 3: | Biomarker Selection | High | Biomarker (MBzP) is known to be related with external exposure to DBzP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected from a cohort in New York City. |
| | Metric 5: | Currency | Low | Sampling began in 1998 until 2002. |
| | Metric 6: | Spatial and Temporal Variability | Low | Maternal urine samples (spot only) totaled 404, and 180 children were evaluated. There was no report of replicates. |
| | Metric 7: | Exposure Scenario | High | Data closely represents relevant exposure scenarios (e.g., biomonitoring study). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics were provided and not raw data. |
| | Metric 9: | Quality Assurance | Low | Limited description of QA/QC techniques besides citing another paper that explained their methods. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability was characterized, but uncertainties and limitations were not discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Wilk, B. K., Fudala-Ksiazek, S., Szopińska, M., Luczkiewicz, A. (2019). Landfill leachates and wastewater of maritime origin as possible sources of endocrine disruptors in municipal wastewater. Environmental Science and Pollution Research 26(25):12-Jan. |
| **HERO ID:** | 5709835 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology for samples of landfill leachate, raw/pre-treated cruise ship wastewater, and municipal wastewater entering the wastewater treatment plant (WWTP) was detailed in terms of sampling equipment, procedures, instrumental calibration and study site characteristics however some sampling methods were not reported, such as sample storage conditions and duration of sample storage. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods such as extraction, instrumentation, instrumental calibration, limits of detection and recoveries were detailed. |
| | Metric 3: | Biomarker Selection | N/A | Samples of environmental media were collected. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Poland. |
| | Metric 5: | Currency | High | Samples were collected in 2015 and 2016. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Sampling of landfill leachate (n=20), raw (n=10) and pre-treated (n=15) cruise ship wastewater and municipal wastewater (n=48) were described as collected 2015-2016 monthly and/or during the tourist season. Replicate sampling was not conducted. |
| | Metric 7: | Exposure Scenario | Medium | In this study in Poland, the exposure scenario was described as wastewater from landfill leachate, raw and pre-treated wastewater from cruise ships/ferries, and municipal wastewater entering a wastewater treatment plant, were tested for the presence of the suspected endocrine-disrupting compounds phthalates (PAEs) and bisphenol A (BPA). Use of exposure controls was not detailed. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data was not reported. Summary statistics of maximum and range were reported. |
| | Metric 9: | Quality Assurance | Medium | Recoveries were reported, but additional key QC parameters, such as pre-exposure control sampling, was not detailed. Recoveries for DEHP (55%) were low. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Measured concentration variability summarized within reported ranges. Few gaps and limitations were reported. |
| **Overall Quality Determination** | | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | Loraine, G. A., Pettigrov, M. E. (2006). Seasonal Variations in Concentrations of Pharmaceuticals and Personal Care Products in Drinking Water and Reclaimed Wastewater in Southern California. Environmental Science & Technology 40(3):687-695. |
| **HERO ID:** | 5743010 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Detailed sampling methodology is discussed. |
| | Metric 2: | Analytical Methodology | Low | The LODs are mentioned but not reported. The recoveries are not reported and the MDLs are reported. |
| | Metric 3: | Biomarker Selection | N/A | Water was sampled for biomarkers of exposure. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in California, USA. |
| | Metric 5: | Currency | Low | Sampling was conducted in 2001-2002. |
| | Metric 6: | Spatial and Temporal Variability | High | Sampling was conducted with 4-5 samples per plant from 4 plants and no replicates. |
| | Metric 7: | Exposure Scenario | Medium | Data may represent a relevant exposure scenario. The methods provide limited details on exposure assessment and population of interest. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | The reporting of results included only the summary statistics. |
| | Metric 9: | Quality Assurance | Low | QC/QC issues is only briefly discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Key uncertainties, study limitations and data gaps are not discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Machtinger, R., Mansur, A., Baccarelli, A. A., Calafat, A. M., Gaskins, A. J., Racowsky, C., Adir, M., Hauser, R. (2018). Urinary concentrations of biomarkers of phthalates and phthalate alternatives and IVF outcomes. Environment International 111:23-31. |
| **HERO ID:** | 5743382 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Well described sampling methods. |
| | Metric 2: | Analytical Methodology | Medium | Limited description, cited previously published work, reported LOD. |
| | Metric 3: | Biomarker Selection | High | Known metabolites resulting from external exposure. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Israel |
| | Metric 5: | Currency | High | Sampling began in 2014, finished in 2016. |
| | Metric 6: | Spatial and Temporal Variability | Low | 136 samples, no replicates |
| | Metric 7: | Exposure Scenario | Medium | Did not discuss relation to exposure sources. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics. |
| | Metric 9: | Quality Assurance | Low | QA/QC not directly discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Did not characterize variability. Discussed uncertainties and study limitations. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | SUNY, (2018). The effect of air change rate and temperature on phthalate concentration in house dust. Science of the Total Environment 639:760-768. |
| **HERO ID:** | 5744397 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The sampling methodology is thoroughly described and scientifically sound. |
| | Metric 2: | Analytical Methodology | Low | The analytical methodology is thoroughly described and scientifically appropriate. The LOD is not provided. |
| | Metric 3: | Biomarker Selection | N/A | Study is testing for concentration in house dust. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in China. |
| | Metric 5: | Currency | High | Samples were collected from 2016 to 2017. |
| | Metric 6: | Spatial and Temporal Variability | High | 20 samples were collected from each location. |
| | Metric 7: | Exposure Scenario | High | The exposure scenario of indoor dust in residential apartments is a scenario of interest and is well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data is not provided. Summary statistics are provided. |
| | Metric 9: | Quality Assurance | High | QA/QC methods are provided. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few limitations and gaps are provided. Variability is not characterized. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Lee, I., Alakeel, R., Kim, S., Al-Sheikh, Y. A., Al-Mandeel, H., Alyousef, A. A., Kho, Y., Choi, K. (2019). Urinary phthalate metabolites among children in Saudi Arabia: Occurrences, risks, and their association with oxidative stress markers. Science of the Total Environment 654:1350-1357. |
| **HERO ID:** | 5750962 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Concise but clear sampling methods. |
| | Metric 2: | Analytical Methodology | High | Detailed analytical methods, reported LOD in Supporting Information. |
| | Metric 3: | Biomarker Selection | High | Biomarker is known to represent external exposure. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Saudi Arabia |
| | Metric 5: | Currency | High | Sampling in 2017. |
| | Metric 6: | Spatial and Temporal Variability | Low | 109 samples, no replicates. |
| | Metric 7: | Exposure Scenario | High | Data closely represent relevant exposure scenarios. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics. |
| | Metric 9: | Quality Assurance | Low | QA/QC not discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Study limitations only briefly discussed. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Dodson, R. E., Udesky, J. O., Colton, M. D., Mccauley, M., Camann, D. E., Yau, A. Y., Adamkiewicz, G., Rudel, R. A. (2017). Chemical exposures in recently renovated low-income housing: Influence of building materials and occupant activities. Environment International 109:114-127. |
| **HERO ID:** | 5755270 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methods are standard SOPs and are detailed in the paper and the SI. |
| | Metric 2: | Analytical Methodology | High | MRLs are tabulated. The paper and SI adequately discuss methodology. |
| | Metric 3: | Biomarker Selection | N/A | Testing for the parent chemical in an environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Boston, MA. |
| | Metric 5: | Currency | Medium | Samples were collected from 2013-2014. |
| | Metric 6: | Spatial and Temporal Variability | High | 10 pre-occupancy and >= 25 post-occupancy samples were collected. Duplicates were collected. |
| | Metric 7: | Exposure Scenario | Medium | Information on potential chemical use not discussed beyond describing the measured concentrations. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics were reported, but no raw data were reported (unless provided in the SI). |
| | Metric 9: | Quality Assurance | High | The QAQC discussion was adequate. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | There was sufficient discussion on variability and uncertainty. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Huang, Y., Li, J., Garcia, J. M., Lin, H., Wang, Y., Yan, P., Wang, L., Tan, Y., Luo, J., Qiu, Z., Ji-An, C., Shu, W. (2014). Phthalate levels in cord blood are associated with preterm delivery and fetal growth parameters in chinese women. PLoS ONE 9(2):e87430. |
| **HERO ID:** | 5755647 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The sampling methodology was described in detail and is scientifically sound. |
| | Metric 2: | Analytical Methodology | High | The analytical methods were described, including recoveries and LOD. |
| | Metric 3: | Biomarker Selection | High | The study tested for parent chemicals in cord blood. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in China. |
| | Metric 5: | Currency | Medium | The samples were collected between 2011 and 2012. |
| | Metric 6: | Spatial and Temporal Variability | High | n=207 volunteers. |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant exposure scenarios related phthalates. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics were reported (mean and percentiles). |
| | Metric 9: | Quality Assurance | High | QA/QC techniques were described in detail. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability was characterized (percentiles). Uncertainties were discussed. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Félix-Cañedo, T. E., Durán-Álvarez, J. C., Jiménez-Cisneros, B. (2013). The occurrence and distribution of a group of organic micropollutants in Mexico City's water sources. Science of the Total Environment 454-455:109-118. |
| **HERO ID:** | 5757303 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Clear and scientifically sound |
| | Metric 2: | Analytical Methodology | High | Detailed methods, reported LODs and recoveries |
| | Metric 3: | Biomarker Selection | N/A | Water samples |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Mexico |
| | Metric 5: | Currency | Medium | Sampling began in 2008 through 2009 |
| | Metric 6: | Spatial and Temporal Variability | High | 26 sites, triplicate samples during two sampling campaigns in different seasons |
| | Metric 7: | Exposure Scenario | High | Data represent a relevant exposure scenario |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics |
| | Metric 9: | Quality Assurance | High | Discussed QA/QC, analyzed control samples, reported recoveries |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Key uncertainties, limitations and data gaps are not discussed |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Han, H., Park, B., Park, B., Ha, E. H., Hye Ah, L., Park, H., Young Sun, H. (2019). Associations of phthalate exposure with lipid levels and insulin sensitivity index in children: A prospective cohort study. Science of the Total Environment 662:714-721. |
| **HERO ID:** | 5772241 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Medium. Most key criteria met. Duration of sample storage data lacking. |
| | Metric 2: | Analytical Methodology | Medium | Medium. Most key criteria met, chemical-specific LOD's reported. |
| | Metric 3: | Biomarker Selection | Low | Low. Sampling for metabolites not specific for parent chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | High. Samples provided by participants in Seoul, South Korea. |
| | Metric 5: | Currency | High | High. Samples collected 2005-2010 for participants at ages 3-5 follow-up, unspecified dates of sampling for additional follow-up urine specimen collection. |
| | Metric 6: | Spatial and Temporal Variability | Low | Low. Urine specimens provided by a total of n=164 children at ages 3-5 years and 7-9 years, but for subjects with two or more follow-ups, data was only analyzed for that obtained at the youngest ages, non-statistical sampling methods. |
| | Metric 7: | Exposure Scenario | Medium | Medium. Participant characteristics summarized, lack of information on pre-exposure or control samples. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Medium. Most key criteria met; lack of raw data. |
| | Metric 9: | Quality Assurance | Medium | Medium. Quality assurance procedures described with most key criteria met; lack of recovery data. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Medium. Variability characterized within summary statistics, minimal potential study limitations of residual confounding and potential storage container contamination reported. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Buckley, J. P., Palmieri, R. T., Matuszewski, J. M., Herring, A. H., Baird, D. D., Hartmann, K. E., Hoppin, J. A. (2012). Consumer product exposures associated with urinary phthalate levels in pregnant women. Journal of Exposure Science & Environmental Epidemiology 22(5):468-475. |
| **HERO ID:** | 5772514 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some sampling methods not reported such as sampler calibration |
| | Metric 2: | Analytical Methodology | Medium | Recovery samples not reported |
| | Metric 3: | Biomarker Selection | Medium | Acceptable biomarker |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | USA |
| | Metric 5: | Currency | Low | Samples collected in 2002 and 2003 |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported |
| | Metric 9: | Quality Assurance | High | Key QA reported |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | Zhang, G., Wang, N., Cheng, X., Sun, Y., Yan, H., Chen, C. (2017). Distribution of persistent organic pollutants (POPs) in atmospheric particles during district heating period (DHP) and non-district heating period (N-DHP) in Shandong province, China. Air Quality, Atmosphere and Health 10(10):1247-1257. |
| **HERO ID:** | 5883076 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling equipment and methods are described in sufficient detail, but certain aspects (e.g. duration of storage) were absent that are unlikely to have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | Low | Analytical instrumentation and methods are described in sufficient detail and are scientifically sound. However, method detection limit is only reported as a range for all phthalates. |
| | Metric 3: | Biomarker Selection | N/A | This study is testing for the parent chemical in an environmental medium. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was performed in Shandong province, China. |
| | Metric 5: | Currency | Medium | Samples were collected in 2009. |
| | Metric 6: | Spatial and Temporal Variability | High | 23h total suspended particulate samples were collected from seven sites for eight days during winter and spring, including quadruple replicates (except for a few instrument malfunctions). |
| | Metric 7: | Exposure Scenario | High | Sampling sites were well characterized based on urban/rural conditions and surrounding geography. All samples were taken at a height inferred to be sufficient to isolate from ground-level point sources. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Raw data were not reported; summary results are presented graphically for each sampling site and season, but summary statistics (i.e. mean or median) were not provided. |
| | Metric 9: | Quality Assurance | High | QA/QC measures included the use of triplicate analysis of standard solutions, laboratory control samples, and matrix spikes. Relative standard deviation, control sample recovery, and spike recovery were all within acceptable ranges. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Characterization of variability was absent except for spatiotemporal variability. Discussion of limitations or sources of uncertainty was also missing. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | LTI Limno-Tech, (1993). Preliminary evaluation of Dow Corning Carrollton, Kentucky environmental effects to surface waters with cover letter dated 04/20/94. |
| **HERO ID:** | 5885319 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Limited description of sampling methods |
| | Metric 2: | Analytical Methodology | Medium | Limited description of analytical methods |
| | Metric 3: | Biomarker Selection | N/A | The authors analyzed environmental samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Ohio, USA |
| | Metric 5: | Currency | Low | Sampling in 1992 |
| | Metric 6: | Spatial and Temporal Variability | Low | Sample size is reported in Appendix B - Laboratory Data Report (page 74 of the 134 pages of the .PDF file). There are 4 water and 4 soil samples. |
| | Metric 7: | Exposure Scenario | Medium | Missing information about the population of interest, limited description of microenvironment |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual sample concentrations, no summary statistics |
| | Metric 9: | Quality Assurance | High | Described QA/QC techniques, analyzed control samples |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Did not characterize variability, or discussed uncertainties and limitations |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Nilsen, E. B., Alvarez, D. (2011). Water-quality monitoring for a pilot piling removal field evaluation, Coal Creek Slough, Washington, 2008-09. :26. |
| **HERO ID:** | 5919173 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Composite piling shaving samples collected from pilings using a hand drill with augur bit. Each sample comprised shavings from two boreholes from two pilings (four bore holes total, homogenized) |
| | Metric 2: | Analytical Methodology | Low | wood analyzed at USGS NWQL; GC-MS but not include multistep clean-up/not rigorous quantification using standardized method; no detection limits reported |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Coal Creek Slough, Washington (Fig 1) |
| | Metric 5: | Currency | Medium | 2008 (before piling removal) and 2009 (after piling removal) |
| | Metric 6: | Spatial and Temporal Variability | Low | each piling sample from two boreholes from two pilings (4 bore holes total, homogenized); further discussion on sampling approach not provided for wood pilings |
| | Metric 7: | Exposure Scenario | Medium | pilot monitoring before and after removal of a piling field; concentrations at piling removal site and at a comparison site |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Appendix A provides concentration and % recovery in wood tailings; no further data reported |
| | Metric 9: | Quality Assurance | Low | QA/QC pertaining to sampling of wood pilings not discussed |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty discussed very limited |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Lee, G., Kim, S., Kho, Y., Kim, S., Lee, S., Choi, G., Park, J., Worakhunpiset, S., Moon, H. B., Okanurak, K., Geounuppakul, M., Tangtitawong, J., Wetsutthanon, K., Trisurat, D., Choi, K. (2019). Urinary levels of phthalates and DINCH metabolites in Korean and Thai pregnant women across three trimesters. Science of the Total Environment 711:134822. |
| **HERO ID:** | 5932874 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most appropriate sampling methods for a biomonitoring study were included. Some sampling methods were not reported such as sampler calibration. |
| | Metric 2: | Analytical Methodology | Medium | The LOD was reported. Some analytical methods were not reported, such as recovery samples. |
| | Metric 3: | Biomarker Selection | High | The study reported an acceptable biomarker. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | This study was conducted in Korea and Thailand. |
| | Metric 5: | Currency | High | Samples were collected in 2016. |
| | Metric 6: | Spatial and Temporal Variability | High | There were >10 samples collected and replicates collected. |
| | Metric 7: | Exposure Scenario | Medium | The exposure source was not well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. |
| | Metric 9: | Quality Assurance | High | Key QA was reported in this study. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Some gaps and limitations were reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Gao, C. J., Wang, F., Shen, H. M., Kannan, K., Guo, Y. (2020). Feminine hygiene products-a neglected source of phthalate exposure in women. Environmental Science & Technology 54(2):930-937. |
| **HERO ID:** | 5932884 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported. Sample location and details of material and products reported. |
| | Metric 2: | Analytical Methodology | Medium | Key analytical methods reported. Extraction and analytical equipment described (centrifuge and GC) but calibration not described. LOQ reported as a range and not individual chemicals. Instrumental analysis described in another study (ref 28). |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples from China |
| | Metric 5: | Currency | High | Samples collected in 2017 and 2018 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 56 Feminine Care Products. 64 Sanitary Napkins. There is mention of duplicates. |
| | Metric 7: | Exposure Scenario | High | Exposure source characterized- feminine care products. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported. Summary statistics (mean, range, median) reported. |
| | Metric 9: | Quality Assurance | High | Key QA reported. Two method blanks, two matrix-spiked samples,and duplicates were analyzed. High recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limitations characterized. Comparison to other feminine products. SD not reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Fisher, M., Arbuckle, T. E., Macpherson, S., Braun, J. M., Feeley, M., Gaudreau, É. (2019). Phthalate and BPA exposure in women and newborns through personal care product use and food packaging. Environmental Science & Technology 53(18):10813-10826. |
| **HERO ID:** | 5932899 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Key criteria met, sample storage duration prior to analysis not reported, sampling methods detailed within text and referenced. |
| | Metric 2: | Analytical Methodology | Medium | Most key criteria described, chemical-specific detection limits reported, analytic methods referenced, recovery data lacking. |
| | Metric 3: | Biomarker Selection | Low | Sampling for metabolites not specific for parent chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples provided by participants of P4 study at clinics within Ottowa, Canada. |
| | Metric 5: | Currency | Medium | Enrollment during pregnancy prior to 20 weeks gestation 2009-2010. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Non-statistical sampling methods; multiple maternal spot urine samples (<= 10 samples) within one 24-hour weekday period, within one 24-hour weekend period, and a single spot urine specimen collected during second trimester (T2), T3 and 2-3 months post-partum for mothers; infant spot urines collected at delivery (n=45) and 2-3 months post-partum (n=55). Total number of maternal urines varied by chemical (n=513-1,260). |
| | Metric 7: | Exposure Scenario | Medium | Participant characteristics summarized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Most key criteria met; lack of raw data. |
| | Metric 9: | Quality Assurance | Low | Most key criteria met, analytic methods referenced; authors note potential for contamination with maternal MnBP and infant MnBP, MEHP, MEOHP samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability characterized within summary statistics, potential study limitations reported; authors note potential for contamination with maternal MnBP and infant MnBP, MEHP, MEOHP samples. |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | Malem, F., Soonthondecha, P., Khawmodjod, P., Chunhakorn, V., Whitlow, H. J., Chienthavorn, O. (2019). Occurrence of phthalate esters in the eastern coast of Thailand. Environmental Monitoring and Assessment 191(10):627. |
| **HERO ID:** | 5933394 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | provide info about sampling site, equipment, procedure |
| | Metric 2: | Analytical Methodology | High | describe analytical methods and provide LOD |
| | Metric 3: | Biomarker Selection | N/A | environmental media |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Pradu Bay and Chakmak Canal, Thailand |
| | Metric 5: | Currency | Medium | 2014 |
| | Metric 6: | Spatial and Temporal Variability | High | 56 seawater and 43 sediment samples. Duplicate samples collected |
| | Metric 7: | Exposure Scenario | Medium | phthalates in seawater near economic/industrial hub |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | provide average standard deviation but not individual concentrations or table of raw data |
| | Metric 9: | Quality Assurance | High | % recovery >75%, used procedural blanks |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | provide measures of variance but don't identify key uncertainties or limitations |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Quynh, T. X., Toan, V. D. (2019). Endocrine disrupting compounds (EDCs) in surface waters of the Kimnguu River, Vietnam. Bulletin of Environmental Contamination and Toxicology 103(5):734-738. |
| **HERO ID:** | 5933601 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Equipment used for sample collection, transportation, and preparation mentioned but not detailed. Surface water collected from 6 sites (Fig 1); at each site, one sample collected in dry season (April) and six samples in wet season (October). 500 mL of water sample filtered. |
| | Metric 2: | Analytical Methodology | Medium | Extraction method discussed (p.735). Analytical equipment (GC-MS-MS-SRM), recoveries, methods described more in Kadokami et al. (2009). MDLs reported as a rang from 0.01-0.05 ng/L. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | KimNguu River, Hanoi, Vietnam |
| | Metric 5: | Currency | High | 2018 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 1 sample in dry season and 6 samples taken in wet season from six sites (no replicates for dry season). |
| | Metric 7: | Exposure Scenario | Medium | River in Vietnam that everyday receives large quantities of industrial, medial, and domestic wastewater; assuming untreated. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Concentration range, mean and std in dry season and wet season reported. Percentages of each chemical at each site provided. No raw data provided. |
| | Metric 9: | Quality Assurance | Medium | Recoveries ranged from 75%-98%; duplicative samples performed. Blanks not taken. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | SD provided in Table 1. discussed variance among seasons and among world studies. No limitations reported. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Karthikraj, R., Lee, S., Kannan, K. (2019). Urinary concentrations and distribution profiles of 21 phthalate metabolites in pet cats and dogs. Science of the Total Environment 690:70-75. |
| **HERO ID:** | 5933622 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some information, such as sampling storage not described. |
| | Metric 2: | Analytical Methodology | High | SI includes LOQ, matrix spike recoveries and recoveries for NIST certified standard reference materials (SRM). Extraction methods, calibration, and equipment also included. |
| | Metric 3: | Biomarker Selection | High | Metabolites in cats and dogs. Biomarker is derived from exposure to the chemical of interest (MBzP). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | New York |
| | Metric 5: | Currency | High | 2017 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 50 cats and 50 dogs, no replicates. |
| | Metric 7: | Exposure Scenario | Medium | Exposure to pets (dogs and cats). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 1 has mean, median, SD, min, max, and detection frequency. Individual points not reported. |
| | Metric 9: | Quality Assurance | High | QA/QC discussed in detail. Procedural blanks analyzed. Recoveries over 70%. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variation in dogs and cats, gender, age, habitat analyzed. Comparison to human exposure also analyzed. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Zhang, Z. M., Yang, G. P., Zhang, H. H., Shi, X. Z., Zou, Y. W., Zhang, J. (2019). Phthalic acid esters in the sea-surface microlayer, seawater and sediments of the East China Sea: Spatiotemporal variation and ecological risk assessment. Environmental Pollution 259:113802. |
| **HERO ID:** | 5933853 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Clear and detailed methods |
| | Metric 2: | Analytical Methodology | High | Included detection limits and recoveries |
| | Metric 3: | Biomarker Selection | N/A | environmental data |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | East China Sea |
| | Metric 5: | Currency | Medium | Began in 2014 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 56 and 98 seawater samples (including surface water samples and the samples at different sampling depths) collected in autumn and spring, respectively. Additionally, 12 SML and 19 sediment samples were obtained in spring. no replicates |
| | Metric 7: | Exposure Scenario | High | Data represent a relevant exposure scenario, included ecological risk assessment |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | includes raw data in supplementary information |
| | Metric 9: | Quality Assurance | High | Detailed QA/QC section, included recoveries, analyzed control samples |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited characterization of uncertainties, study limitations and data gaps |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Bechtel Environmental, (1988). Final site investigation report for the Rohm and Haas Redwood City Facility. |
| **HERO ID:** | 6307465 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology is discussed and is generally appropriate (i.e., scientifically sound) for the chemical and media of interest. Details regarding soil sampling page 18-23, 28; groundwater sampling page 37-38, 41-47; monitoring well sampling page 48-58; concrete and asphalt sampling page 60-64. |
| | Metric 2: | Analytical Methodology | High | Samples were analyzed according to EPA Methods. Table 2-2 reports EPA methods followed for each contaminant. |
| | Metric 3: | Biomarker Selection | N/A | Study tested for the parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in California, USA. |
| | Metric 5: | Currency | Low | Samples were collected in 1986-1987. |
| | Metric 6: | Spatial and Temporal Variability | High | Duplicate samples were collected for all media types; 95 soil samples, 53 groundwater samples, 26 monitoring well samples, and 55 concrete and asphalt samples. |
| | Metric 7: | Exposure Scenario | Medium | The data likely represent relevant/realistic exposure scenario, but the use of expose controls was not described. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data reported in Tables 4-2, A-2, A-3. No summary statistics reported. |
| | Metric 9: | Quality Assurance | Medium | The use of QA/QC techniques were described such as the use of standards, blanks, laboratory duplicates, field duplicates, and spikes. However, recovery values and baseline samples were not reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | The study has limited characterization of variability and no measure of variance is provided. Key uncertainties, limitations, and data gaps are not discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Hargis & Montgomery Inc, (1984). Phase I Investigation of Groundwater Quality and Hydrogeological Conditions Summa Corporation Facility Culver City, California. |
| **HERO ID:** | 6311565 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling methods were only briefly described. |
| | Metric 2: | Analytical Methodology | Low | The authors cited analytical methods from EPA with brief descriptions. |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in the USA. |
| | Metric 5: | Currency | Low | Samples were collected in 1983. |
| | Metric 6: | Spatial and Temporal Variability | High | 14 monitoring wells, with replicates. |
| | Metric 7: | Exposure Scenario | Medium | The data may represent a relevant exposure scenario, but it's missing details about the population of interest. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only individual sample concentrations were reported. |
| | Metric 9: | Quality Assurance | High | The authors described QA/QC techniques and analyzed control samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | The authors did not characterize variability or uncertainties. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Mercier, F., Gilles, E., Soulard, P., Mandin, C., Dassonville, C., Le Bot, B. (2020). On-line coupling of thermal extraction with gas chromatography / tandem mass spectrometry for the analysis of semivolatile organic compounds in a few milligrams of indoor dust. Journal of Chromatography A 1615:460768. |
| **HERO ID:** | 6393969 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Random subsample of 5 dust samples collected in French schools. The locations (within each school) of the dust samples are not reported. |
| | Metric 2: | Analytical Methodology | High | LOD and LOQ reported. Results show that the new method performs as well as the conventional method for standard reference materials. |
| | Metric 3: | Biomarker Selection | N/A | N/A since testing for parent chemical in an environmental medium. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | France |
| | Metric 5: | Currency | Medium | 2013 to 2017 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 5 samples. Replicate samples were used to compare the two methods. Replicates were also used for the 5 school dust samples. |
| | Metric 7: | Exposure Scenario | High | School data is from a large school survey. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | SI lists summary statistics for the 5 replicates of all 5 samples. |
| | Metric 9: | Quality Assurance | High | Thorough QA/QC discussion. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Good discussion of uncertainties/variability in main paper. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | McKesson Environmental Services, (1984). Priority pollutant analysis. |
| **HERO ID:** | 6574972 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Critically Deficient | The groundwater sampling methodology was not described. |
| | Metric 2: | Analytical Methodology | Critically Deficient | The analytical methodology was not described. |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in groundwater. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in California, USA. |
| | Metric 5: | Currency | Low | The analysis is from 1984. |
| | Metric 6: | Spatial and Temporal Variability | Critically Deficient | The sample size is not reported. |
| | Metric 7: | Exposure Scenario | Low | The data may represent a relevant exposure scenario, but the document lacks sufficient details about sampling and analytical methods, population of interest and microenvironment characteristics. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | The authors only reported individual sample concentrations, without summary statistics. |
| | Metric 9: | Quality Assurance | Low | QA/QC techniques were not described, control samples were not analyzed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability was not characterized. Uncertainties and limitations were not described. |

## Overall Quality Determination — Uninformative

| | |
|---|---|
| **Study Citation:** | Başaran, B., Soylu, G. N., Yılmaz Civan, M. (2020). Concentration of phthalate esters in indoor and outdoor dust in Kocaeli, Turkey: implications for human exposure and risk. Environmental Science and Pollution Research International 27(2):1808-1824. |
| **HERO ID:** | 6813710 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology for samples of indoor and outdoor dust were described in terms of sampling equipment, procedures, and sample storage conditions, but were lacking storage duration details. |
| | Metric 2: | Analytical Methodology | High | Limits of quantification were reported. Analytical methodology was detailed in terms of extraction, analytical instrumentation, calibration, and recoveries. Extraction was described as conducted according to modified U.S. EPA methods. |
| | Metric 3: | Biomarker Selection | N/A | Sampling was conducted within environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sampling was conducted in Kocaeli, Turkey. |
| | Metric 5: | Currency | High | Sampling was conducted in 2016. |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicate samples were collected, however a total of n=90 samples were collected for indoor dust and n=90 samples were collected for outdoor dust. |
| | Metric 7: | Exposure Scenario | High | Indoor and outdoor dust sampling was conducted within an industrialized area of Turkey between February and April of 2016. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data was provided. Statistical summary measures included median, mean, standard deviation and range. Frequencies of detection were noted. |
| | Metric 9: | Quality Assurance | Medium | Quality assurance procedures were detailed and included analytical instrument calibration and recoveries, but no pre-exposure sampling was conducted. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | The study characterizes variability but overall study limitations were not detailed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Chen, J., Shi, X., Zhou, X., Dong, R., Yuan, Y., Wu, M., Chen, W., Liu, X., Jia, F., Li, S., Yang, Q., Chen, B. (2020). Renal function and the exposure to melamine and phthalates in Shanghai adults. Chemosphere 246:125820. |
| **HERO ID:** | 6813754 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Limited description of sampling methodology. |
| | Metric 2: | Analytical Methodology | High | Detailed analytical methods, reported LOD. |
| | Metric 3: | Biomarker Selection | High | Biomarker is known to be related to external exposure. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Shanghai, China |
| | Metric 5: | Currency | Medium | Samples from 2012. |
| | Metric 6: | Spatial and Temporal Variability | Low | n = 1663, no replicates. |
| | Metric 7: | Exposure Scenario | High | Data closely represent relevant exposure scenarios. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Concentration data was not provided in manuscript or in SI. |
| | Metric 9: | Quality Assurance | High | Described QA/QC techniques, analyzed control samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability was not characterized, uncertainties and limitations were discussed. |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | Chin, H. B., Jukic, A. M., Wilcox, A. J., Weinberg, C. R., Ferguson, K. K., Calafat, A. M., Mcconnaughey, D. R., Baird, D. D. (2019). Association of urinary concentrations of early pregnancy phthalate metabolites and bisphenol A with length of gestation. Environmental Health 18(1):80. |
| **HERO ID:** | 6813785 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | All pertinent sampling methods were described. This paper continued the North Carolina Early Pregnancy Study (EPS), a prospective cohort study. In the early 1980s, daily first-morning urine samples were collected in polypropylene jars, and women were monitored for pregnancy for EPS. In this study, during 2010-2011, women were re-contacted to determine outcome of pregnancy. Those available had urine tested for phthalate metabolites. Investigators pooled three pre-conception and three post-conception urine samples for each woman. |
| | Metric 2: | Analytical Methodology | Low | U.S. CDC analyzed urine samples using SPE isotope dilution HPLC-MS/MS, as described in Silva et al. (2007), HERO 807138. Possible effects of long-term frozen storage on phthalate metabolite concentrations evaluated by Baird et al. (2010), HERO 673435. LODs/LOQs were not reported. |
| | Metric 3: | Biomarker Selection | High | MBzP is a specific metabolite of BBzP. All concentrations were standardized to creatinine mass measured in pooled urine samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted in North Carolina. |
| | Metric 5: | Currency | Low | Urine samples collected in 1982 through 1986 and analyzed after 2007. Thus, samples were frozen for at least two decades before analysis. |
| | Metric 6: | Spatial and Temporal Variability | Medium | First morning urine samples were collected daily. Three preconception samples from the same woman were pooled to minimize episodic spikes in phthalate metabolites in urine (n=125 women). Similarly, three post-conception samples were pooled for each woman (n=121). Primarily Monday samples, collected one week apart, were pooled. |
| | Metric 7: | Exposure Scenario | Medium | No exposure scenarios were specified because exposure is presumed to be widespread. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 1 presented median and IQR for metabolite concentrations and the same statistics for the molar sum of all four DEHP metabolites. Raw data were not provided. |
| | Metric 9: | Quality Assurance | Low | No explicit discussion of QA/QC techniques, but can be implied through its use of CDC laboratory for analysis. QA/QC was also discussed in HERO 673435, although MECPP was not included in that report. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variance was characterized with IQR in Table 1. Limitations were described in Discussion.HERO 673435 described variation in metabolite concentrations among first morning urine samples within and between women and over time; it also compared variation in first morning urine to spot samples from other studies. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Ferguson, K. K., Rosen, E. M., Barrett, E. S., Nguyen, R. H. N., Bush, N., Mcelrath, T. F., Swan, S. H., Sathyanarayana, S. (2019). Joint impact of phthalate exposure and stressful life events in pregnancy on preterm birth. Environment International 133(Pt B):105254. |
| **HERO ID:** | 6813951 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | The sampling methodology was briefly described, citing previously published work. |
| | Metric 2: | Analytical Methodology | Medium | The analytical methods were well-described but did not include LODs or recoveries. |
| | Metric 3: | Biomarker Selection | High | The urine metabolites are closely associated with exposure to the parent chemicals. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | USA |
| | Metric 5: | Currency | Medium | The sampling campaign occurred between 2010 and 2012. |
| | Metric 6: | Spatial and Temporal Variability | High | The study included n=783 study participants that provided urine samples at three routine visits. |
| | Metric 7: | Exposure Scenario | High | The data closely represent scenarios of phthalate exposure in pregnant women in the U.S. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics were reported (median, IQR). |
| | Metric 9: | Quality Assurance | Low | QA/QC techniques were not described by the authors. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variability was characterized (IQR). The authors discussed uncertainties and study limitations. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Urbancova, K., Lankova, D., Sram, R. J., Hajslova, J., Pulkrabova, J. (2019). Urinary metabolites of phthalates and di-iso-nonyl cyclohexane-1,2-dicarboxylate (DINCH)-Czech mothers' and newborns' exposure biomarkers. Environmental Research 173:342-348. |
| **HERO ID:** | 6814511 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported. Sampling methods, equipment, storage described. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported. Extraction methods, analytical instrument, LOQ reported, calibration standards used. |
| | Metric 3: | Biomarker Selection | High | Metabolite is derived from parent chemical (MBzP). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Czech Republic |
| | Metric 5: | Currency | Medium | Samples collected in 2013 and 2014 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 204 samples. No replicates. |
| | Metric 7: | Exposure Scenario | High | Measuring metabolites in pregnant women and newborns. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported. Mean, median, min and max reported. |
| | Metric 9: | Quality Assurance | High | Key QA reported. Recoveries of 70–126%. A procedural blank sample, which contained deionised water instead of urine, was prepared with each set of samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | No limitations discussed. Comparison of results with other studies. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Huang, P. C., Chang, W. H., Wu, M. T., Chen, M. L., Wang, I. J., Shih, S. F., Hsiung, C. A., Liao, K. W. (2020). Characterization of phthalate exposure in relation to serum thyroid and growth hormones, and estimated daily intake levels in children exposed to phthalate-tainted products: A longitudinal cohort study. Environmental Pollution 264:114648. |
| **HERO ID:** | 6815852 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | While urine sample collection is relatively straightforward, the study's description of sampling methods is still limited. |
| | Metric 2: | Analytical Methodology | Medium | The analytical protocol mostly referenced previously published methods and did not include general information on key information (e.g., extraction). |
| | Metric 3: | Biomarker Selection | High | MBzP is specific to BBzP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was performed in Taiwan. |
| | Metric 5: | Currency | High | Sampling began in 2012 and lasted through 2016. |
| | Metric 6: | Spatial and Temporal Variability | Low | Researchers recruited 166 children to participate. Spot urine samples - presumably unpooled - were collected. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study were exposure has presumably occurred during the 2011 food scandal. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics and no raw data were provided. |
| | Metric 9: | Quality Assurance | Low | QA/QC techniques were not discussed but can be implied through the study's use of previously published protocols. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Variance was characterized and uncertainties and limitations were discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Kim, J. H., Kim, D., Moon, S. M., Yang, E. J. (2020). Associations of lifestyle factors with phthalate metabolites, bisphenol A, parabens, and triclosan concentrations in breast milk of Korean mothers. Chemosphere 249:126149. |
| **HERO ID:** | 6815879 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods (e.g., equipment, collection procedure, storage conditions) were reported. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods (e.g., extraction, instrumentation, LOQs, recoveries) were reported. |
| | Metric 3: | Biomarker Selection | High | MBzP is specific to BBzP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Korea. |
| | Metric 5: | Currency | High | Samples were collected in 2018. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 221 samples were collected without replicates. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study that presumed exposure already occurred. Authors broadly discussed possible sources of exposure and aimed to evaluate associations between endocrine disruptions detected in breast milk and consumption of certain foods or use of certain products. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. |
| | Metric 9: | Quality Assurance | High | QA/QC techniques included tests of linearity, accuracy, precision, LOQs, and recoveries. Recoveries were acceptable. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variance characterized with standard deviation. Some gaps and limitations were reported, but focused mostly on estimates of daily intake. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Kim, S., Lee, Y. S., Moon, H. B. (2020). Occurrence, distribution, and sources of phthalates and non-phthalate plasticizers in sediment from semi-enclosed bays of Korea. Marine Pollution Bulletin 151:110824. |
| **HERO ID:** | 6815967 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methods were only briefly described and references to other published studies were provided for more details. |
| | Metric 2: | Analytical Methodology | High | All key analytical methods (e.g., extraction method, instrumentation) were reported, but individual LOQs were not provided for each phthalate. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in sediment. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Musan Bay, Korea. |
| | Metric 5: | Currency | Medium | Samples were collected in 2013. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Sixty samples were collected without replicates. |
| | Metric 7: | Exposure Scenario | High | Industrial and domestic discharges to the bay and its ecological risks were described. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. |
| | Metric 9: | Quality Assurance | Low | QA/QC techniques were described in detail. Recoveries were <70% for several of the phthalates, and no corrections were explained. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Gaps and limitations were only minimally discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | SUNY, (2019). Semi-volatile organic compounds in infant homes: Levels, influence factors, partitioning, and implications for human exposure. Environmental Pollution 251:609-618. |
| **HERO ID:** | 6815979 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology were provided and described, including sampling procedure, equipment, storage, and matrix characteristics. |
| | Metric 2: | Analytical Methodology | High | Analytical methodology was provided and briefly described. Samples were Soxhlet extracted and analyzed using GC-MS. |
| | Metric 3: | Biomarker Selection | N/A | The analyte measured is the TSCA chemical. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The samples were collected in China. |
| | Metric 5: | Currency | Medium | Data were collected from December 2013 to March 2014. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 25 air samples, 25 dust samples, and 18 window filmsamples were collected. No replicate data were collected. |
| | Metric 7: | Exposure Scenario | High | The samples were collected in indoor environment, which represent the exposure of anyone who comes into contact with these home environment. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. Summary statistics including median, mean, and standard deviation were reported. |
| | Metric 9: | Quality Assurance | High | Analytical QA/QC were reported. The recoveries in this study ranged from 64.1% to 132%. All the SVOC concentrations in real samples were corrected with blanks and recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Some sources of variability and uncertainty were discussed and significance values were reported (p values). |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Lee, Y. S., Lim, J. E., Lee, S., Moon, H. B. (2020). Phthalates and non-phthalate plasticizers in sediment from Korean coastal waters: Occurrence, spatial distribution, and ecological risks. Marine Pollution Bulletin 154:111119. |
| **HERO ID:** | 6815985 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling regimen was not reported, and description of other methods (e.g., equipment) was sparse. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods were reported, including reference to previously published method. LOQs presented in Table S3. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in sediment. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected from Korean coastal waters. |
| | Metric 5: | Currency | High | Samples were collected in 2016. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Sediment was collected from 50 locations without replicates. |
| | Metric 7: | Exposure Scenario | Medium | Exposure source was not well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. |
| | Metric 9: | Quality Assurance | Medium | QA/QC techniques were reported. The mean recovery for each chemical is >70%, but when considering the standard deviations, almost all recoveries fall below 70%. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Limitations and gaps were not characterized. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Li, X. H., Ma, L. L., Liu, X. F., Fu, S., Cheng, H. X., Xu, X. B. (2006). Phthalate ester pollution in urban soil of Beijing, People's Republic of China. Bulletin of Environmental Contamination and Toxicology 77(2):252-259. |
| **HERO ID:** | 6816020 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported- including equipment, procedures, and storage. |
| | Metric 2: | Analytical Methodology | Medium | Key analytical methods reported for extraction and analysis (centrifugation and GC). Recoveries reported. LOD reported as a range and equipment calibration not reported. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Beijing, China |
| | Metric 5: | Currency | Low | Sampling date not reported. Study published in 2006. |
| | Metric 6: | Spatial and Temporal Variability | Medium | At least 30 samples. No replicates |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized- soil in urban and rural area. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported. Summary statistics provided (min, max, range, mean). |
| | Metric 9: | Quality Assurance | High | QA criteria reported, such as recoveries and matrix blanks reported as ranges. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | The study mentions that there is a lack of environmental quality standard for soil about PAEs in China. SD reported and spatial variation analyzed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Liang, Y., Li, Z., Shi, P., Ling, C., Chen, X., Zhou, Q., Li, A. (2019). Performance of a novel magnetic solid-phase-extraction microsphere and its application in the detection of organic micropollutants in the Huai River, China. Environmental Pollution 252:196-204. |
| **HERO ID:** | 6816021 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Detailed description of sampling locations, equipment, procedure, storage. |
| | Metric 2: | Analytical Methodology | High | Extraction detailed. Analytical method, equipment (GC-MS), calibration, detection limits reported. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Huai River, China |
| | Metric 5: | Currency | Low | Don't mention a sampling date but published in 2019. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 18 samples. No replicates. |
| | Metric 7: | Exposure Scenario | High | River flows through densely populated areas in China and previous studies have recorded severe water populations. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Provide individual sample concentrations in supplementary info (Table S4) but no summary stats/measures of variance. |
| | Metric 9: | Quality Assurance | High | Recoveries all above 75% (Figure 3D); used blanks and standards. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Compared results of different areas. No appropriate measure of variance or limitations. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Ma, B., Wang, L., Tao, W., Liu, M., Zhang, P., Zhang, S., Li, X., Lu, X. (2020). Phthalate esters in atmospheric PM2.5 and PM10 in the semi-arid city of Xi'an, Northwest China: Pollution characteristics, sources, health risks, and relationships with meteorological factors. Chemosphere 242:125226. |
| **HERO ID:** | 6816027 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling equipment and methods are described in sufficient detail, but certain aspects (e.g. duration of storage) were absent that are unlikely to have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | Medium | Analytical instrumentation and methods are described in sufficient detail, including reporting of method detection limits for each analyte, but certain aspects (e.g. instrument calibration) were absent that are unlikely to have a substantial impact on results. |
| | Metric 3: | Biomarker Selection | N/A | This study is testing for the parent chemical of interest in an environmental medium. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Xi'an, China |
| | Metric 5: | Currency | High | December 2016 - November 2017 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 24h particulate matter samples from two sites over the course of a year, but no replicates (130 total samples) |
| | Metric 7: | Exposure Scenario | High | The sampling sites were well characterized (urban or suburban, seasonal weather patterns) and reasonably separated from any point sources of pollution |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data are not reported; summary statistics include the minimum, maximum, mean, standard deviation, and coefficient of variation of concentrations. |
| | Metric 9: | Quality Assurance | High | QA/QC methods include the use of blanks and surrogate standards to determine background contamination, which was corrected if present, and average recoveries, which were in acceptable ranges. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Characterization of variation is reported. Limitations and sources of uncertainty are only briefly discussed, including the relatively limited number of samples for stratified analyses. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Liu, X., Peng, C., Shi, Y., Tan, H., Tang, S., Chen, D. (2019). Beyond Phthalate Diesters: Existence of Phthalate Monoesters in South China House Dust and Implications for Human Exposure. Environmental Science & Technology 53(20):11675-11683. |
| **HERO ID:** | 6816038 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology is thoroughly described and scientifically sound. No key details are omitted. |
| | Metric 2: | Analytical Methodology | High | Analytical method is thoroughly described and sound. LOQ is provided in supplemental material. |
| | Metric 3: | Biomarker Selection | High | Acceptable biomarker selected for concentration in urine. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples collected in China. |
| | Metric 5: | Currency | High | Samples collected from 2018-2019. |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicates collected. |
| | Metric 7: | Exposure Scenario | Medium | The source of exposure was not well characterized, but this is an exposure scenario of interest. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data is not provided, but summary statistics are given. |
| | Metric 9: | Quality Assurance | High | QA/QC methods are provided and no issues were identified. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited gaps and limitations are reported. Characterization of variability is limited but the range is provided. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Nagorka, R., Koschorreck, J. (2020). Trends for plasticizers in German freshwater environments - Evidence for the substitution of DEHP with emerging phthalate and non-phthalate alternatives. Environmental Pollution 262:114237. |
| **HERO ID:** | 6816080 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Provides overview of sampling procedure with additional details in supplemental info (Section 1, Tables S1 and S2); follows the German Environmental Specimen Bank (ESB) procedures. |
| | Metric 2: | Analytical Methodology | High | Used LC-MS and provide LOD in supplemental info (Table S6). |
| | Metric 3: | Biomarker Selection | N/A | Water sampling |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Germany |
| | Metric 5: | Currency | High | 2017 |
| | Metric 6: | Spatial and Temporal Variability | High | 13 sampling sites with monthly samples at each site pooled into one annual sample; n = 11 for plasticizer concentration average. |
| | Metric 7: | Exposure Scenario | High | Monitoring plasticizers in waters (previous studies have found DEHP and other phthalates). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Average, median, range, sample size (n=11), and detection frequency; no individual sample concentrations. |
| | Metric 9: | Quality Assurance | High | Recoveries >75% (see Table 7 supplementary info); used blanks and controls. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Measured relative standard deviation for repeatability; discuss some limitations. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Paluselli, A., Kim, S. K. (2020). Horizontal and vertical distribution of phthalates acid ester (PAEs) in seawater and sediment of East China Sea and Korean South Sea: Traces of plastic debris?. Marine Pollution Bulletin 151:110831. |
| **HERO ID:** | 6816206 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | sampling horizontal and vertically in water column and sediments in the area; sampling location (Fig 1 and p.3); water collected in Niskin bottles; duplicates at each water depth; stored at 4C; sediment collected via grab sampler, stored in glass bottles at -20C and freeze dried, ground, and sieved |
| | Metric 2: | Analytical Methodology | High | SPE (seawater) and ultrasonic bath (sediments); GC/MS; recoveries; LOQ provided in Table S1 |
| | Metric 3: | Biomarker Selection | N/A | Environmental media |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Northwest Pacific marginal seas (South China Sea, East Sea/Sea of Japan, Yellow Sea, and the East China Sea) |
| | Metric 5: | Currency | High | 2018 |
| | Metric 6: | Spatial and Temporal Variability | High | 88 seawater samples from 8 stations in September; sediment collected from each station (8 samples total). Duplicate water samples collected at each water depth |
| | Metric 7: | Exposure Scenario | High | seawater at different water depths and sediment from northwest Pacific marginal sea |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 1 provides the concentration in sediment from the three main water masses (mean and range per each sector); Raw data not provided |
| | Metric 9: | Quality Assurance | High | recoveries in seawater and sediments provided Table S1; blanks |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | compared results in water and sediment by area and recent studies |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Ramzi, A., Gireeshkumar, T. R., Rahman, K. H., Balachandran, K. K., Shameem, K., Chacko, J., Chandramohanakumar, N. (2020). Phthalic acid esters - A grave ecological hazard in Cochin estuary, India. Marine Pollution Bulletin 152:110899. |
| **HERO ID:** | 6816241 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Authors provided some sampling procedures and cited a peer-reviewed method they followed. |
| | Metric 2: | Analytical Methodology | Low | No LOD or LOQ reported |
| | Metric 3: | Biomarker Selection | N/A | Study measures parent chemical in the environment. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Cochin estuary, India |
| | Metric 5: | Currency | Medium | data collected in 2013 |
| | Metric 6: | Spatial and Temporal Variability | High | data collected in 15 locations in triplicate |
| | Metric 7: | Exposure Scenario | High | Surface and bottom water samples collected from an area of ecological and economic significance |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | no raw data |
| | Metric 9: | Quality Assurance | High | Pertinent QA/QC information (e.g., blanks, recoveries) was provided |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | No limitations reported |

**Overall Quality Determination** **High**

| | |
|---|---|
| **Study Citation:** | Tang, Z., Chai, M., Cheng, J., Wang, Y., Huang, Q. (2019). Occurrence and distribution of phthalates in sanitary napkins from six countries: Implications for women's health. Environmental Science & Technology 53(23):13919-13928. |
| **HERO ID:** | 6816332 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | The study mentions that random supermarkets were chosen and brands were chosen based on a questionnaire but no details on the supermarkets and the questionnaire are reported. |
| | Metric 2: | Analytical Methodology | Medium | Extraction methods, analytical instruments and methods described. Quantitation was performed using the internal calibration method based on 35 five-point calibration curve for individual phthalates. LOQ reported as a range and not for individual chemicals. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Japan, South Korea, US, UK, Australia, Germany |
| | Metric 5: | Currency | High | Samples collected in 2016. |
| | Metric 6: | Spatial and Temporal Variability | High | 72 samples. It is not explicitly mentioned but inferred that there is a replicate for each sample (6 samples for 6 countries- two samples each for 72 total). |
| | Metric 7: | Exposure Scenario | High | Exposure source relevant for sanitary napkin exposure to women. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Median, 10th, 50th, and 90th percentiles reported. Raw data not reported. |
| | Metric 9: | Quality Assurance | High | QA reported. The recoveries of 15 target phthalates in spiked matrices ranged from 81.9 to 107%. Procedural blanks used. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Several limitations mentioned. Variation in locations and brands analyzed. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Wei, L., Li, Z., Sun, J., Zhu, L. (2020). Pollution characteristics and health risk assessment of phthalate esters in agricultural soil and vegetables in the Yangtze River Delta of China. Science of the Total Environment 726:137978. |
| **HERO ID:** | 6816706 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | The sampling methods for topsoil and vegetables, including sampling equipment, procedures and storage conditions, were adequately described, however sample storage duration was not detailed. The detailed collection procedures followed a previous study (Sun et al., 2016). |
| | Metric 2: | Analytical Methodology | High | Analytical methods were adequately described and included descriptions of extraction, analytical instrumentation, instrument calibration and limits of detection (range 0.1 to 0.5ng/g) and recoveries. |
| | Metric 3: | Biomarker Selection | N/A | The sampling was conducted in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Sampling was conducted in the Yangtze River Delta area of China. |
| | Metric 5: | Currency | High | The study was conducted in 2018. |
| | Metric 6: | Spatial and Temporal Variability | Medium | A total of n=228 topsoil and vegetable samples were obtained however replicate sampling was lacking. |
| | Metric 7: | Exposure Scenario | Medium | The exposure scenario within the Yangtze River delta area of China was adequately described, however use of exposure controls was lacking. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics included detection frequency, min, max, mean, median however raw data was lacking. |
| | Metric 9: | Quality Assurance | Medium | Quality assurance procedures were adequately described and included laboratory recoveries and blanks. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and uncertainty were not discussed, however no obvious concerns were identified. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Wu, H., Kupsco, A. J., Deierlein, A. L., Just, A. C., Calafat, A. M., Oken, E., Braun, J. M., Mercado-Garcia, A., Cantoral, A., Téllez-Rojo, M. M., Wright, R. O., Baccarelli, A. A. (2020). Trends and patterns of phthalates and phthalate alternatives exposure in pregnant women from Mexico City during 2007-2010. Environmental Science & Technology 54(3):1740-1749. |
| **HERO ID:** | 6817118 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling equipment and methods are described in sufficient detail, but certain aspects (e.g. duration of storage) are absent that are unlikely to have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | Low | Analytical instrumentation and methods (high-performance liquid chromatography coupled with tandem MS) are only briefly described but are referenced to a previous publication. LOD is only provided as a range for all analytes. |
| | Metric 3: | Biomarker Selection | Low | Metabolites of phthalates were measured in urine. However, two metabolites could be derived from multiple parents (including one metabolite that could be derived from this chemical), and no effort was made to apportion them. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Mexico |
| | Metric 5: | Currency | Medium | Samples were from 2007-2011. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Pooled urine spot samples from 948 participants in the second trimester of pregnancy and samples from 792 of the same participants in the third trimester. No replicates were collected from the same population at the same point in time. |
| | Metric 7: | Exposure Scenario | High | Exposure scenario is relevant for pregnant women and fetuses during gestation. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data are not reported in the paper or SI. Summary statistics reported include detection rate and percentiles (25, 50, 75, 90) of the metabolite concentrations measured. |
| | Metric 9: | Quality Assurance | Medium | QA is not discussed much. There is a passing reference to "standard analytical QC protocols of the CDC laboratory." Additionally, a random sample collected outside the study design was analyzed 92 times as a blinded replicate sample. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | There is no discussion of uncertainty. Some information about variability can be gleaned from reporting the 25th/50th/75th/90th percentile measurements. There is some discussion of limitations. |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | SUNY, (2020). Phthalate exposure in Chinese homes and its association with household consumer products. Science of the Total Environment 719:136965. |
| **HERO ID:** | 6817545 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sample matrix/characteristics, equipment, regimen, storage, and more were well described. |
| | Metric 2: | Analytical Methodology | High | Extraction, analytical instruments, LODs/LOQs, recoveries and more were well described. |
| | Metric 3: | Biomarker Selection | N/A | Study measured parent chemicals in indoor dust. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected from homes in Tianjin and Cangzhou, China. |
| | Metric 5: | Currency | Medium | Data collected between Sept 2013 and Jan 2016. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Dust was collected from 399 homes without replicates. |
| | Metric 7: | Exposure Scenario | High | Phthalate exposure via indoor dust from household products is relevant. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | No raw data were provided. |
| | Metric 9: | Quality Assurance | High | QA/QC described, including blanks, spiked samples, and recoveries (all acceptable). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No information was provided on gaps and limitations. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Zhao, X., Shen, J. M., Zhang, H., Li, X., Chen, Z. L., Wang, X. C. (2020). The occurrence and spatial distribution of phthalate esters (PAEs) in the Lanzhou section of the Yellow River. Environmental Science and Pollution Research 27(16):19724-19735. |
| **HERO ID:** | 6817577 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Surface water samples (0-50cm) collected and stored in glass bottles while 50g surface sediment (0-10cm) concurrently collected and stored in steel jars; Fig 1 and Table 2 provide information on location of sampling sites; water stored at 4C and sediment at -20C; water passed through filter; sediment freeze dried and grinded |
| | Metric 2: | Analytical Methodology | Medium | Liquid-liquid extraction; GC-MS; recoveries; LOD reported as a range from 0.05-0.74 ng/L for water and 0.008-0.26 ng/g for sediment; SI has more information. No instrument calibration. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Yellow River, Lanzhou, Gansu Province, China |
| | Metric 5: | Currency | High | August 2016-March 2017 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 12 stations, each sampled during dry and wet periods. No replicates. |
| | Metric 7: | Exposure Scenario | High | Surface water and sediment from a river in an industrial base and integrated transportation hub. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 3 provides average, range, and DF for water in rainy season and dry season; Table 4 for sediment. Individual points not reported. |
| | Metric 9: | Quality Assurance | High | Recoveries ranged from 70-140%. Deionized water and diatomite sediment blank samples (n = 3) were extracted similar to the real samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Examined temporal and spatial distribution in the river (fig 2 and 3; Table 5 and 6); compared findings to previous studies and other areas. No limitations reported. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Streck, G., Herrmann, R. (2000). Distribution of endocrine disrupting semivolatile organic compounds in several compartments of a terrestrial ecosystem. Water Science and Technology 42(7):39-44. |
| **HERO ID:** | 6821588 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most sampling methods described, including equipment, procedures, and storage. Missing equipment calibration and study site could be described in more detail. |
| | Metric 2: | Analytical Methodology | Low | Equipment described for extraction and analysis (GPC and GC/MS). Calibration and LOD not provided. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Germany |
| | Metric 5: | Currency | Low | 1998-1999 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 5-7, no replicates |
| | Metric 7: | Exposure Scenario | Medium | Analyzed for chemicals in rain, snow, topsoil, spruce needles. More information could be given for how this affects exposure. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Range provided (no mean or median) for aerosol particles, vapour phase and precipitation. Only averaged concentrations reported for topsoil and spruce needles. |
| | Metric 9: | Quality Assurance | Low | No QA methods discussed but can be implied through the study's use of standard field and laboratory protocols. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability and uncertainty not discussed, no SD reported. No limitations of monitoring discussed. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Chuang, S. C., Chen, H. C., Sun, C. W., Chen, Y. A., Wang, Y. H., Chiang, C. J., Chen, C. C., Wang, S. L., Chen, C. J., Hsiung, C. A. (2020). Phthalate exposure and prostate cancer in a population-based nested case-control study. Environmental Research 181:108902. |
| **HERO ID:** | 6826333 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Certain details of sample collection (e.g. collection procedures) are missing that could have a substantial impact on results (but may have been reported elsewhere where the cohort was first described). The spot urine samples were frozen at -30 C for over 20 years before analysis. The discussion mentions that the samples were stored in plastic vials. |
| | Metric 2: | Analytical Methodology | Medium | Analytical instrumentation and methods are described in sufficient detail. LODs are reported. Blanks were used, but certain aspects (e.g., recovery samples and instrument calibration) are not discussed, but are not likely to have a substantial impact on results. |
| | Metric 3: | Biomarker Selection | Low | One monoester phthalate biomarker is a metabolite of multiple parent chemicals, not just this chemical, and there is not a stated method to apportion the estimate to just the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Taiwan |
| | Metric 5: | Currency | Low | 1991-1992 |
| | Metric 6: | Spatial and Temporal Variability | Low | Spot urine samples from 236 participants. I do not see evidence of the samples having been pooled, so I rated this as low. |
| | Metric 7: | Exposure Scenario | Medium | A "lifestyle questionnaire" was administered to participants who gave urine samples, which would reflect the totality of their exposures to phthalates. Data were not broken down based on different characteristics, such as whether the participant smoked. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data points are not reported; summary statistics include the detection rate, geometric mean, and percentiles (5, 25, 50, 75, 95) of concentration. Samples were broken out by whether the participant was or was not later diagnosed with prostate cancer. |
| | Metric 9: | Quality Assurance | Medium | Measurements were performed at a laboratory which conducts annual external quality assurance following accepted protocols. Additionally, inter- and intra-batch coefficients of variance are reported and were less than or equal to 27%. Blanks were also sampled in each batch. No other discussion of particular QA measures was included. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Coefficients of variation were reported for each metabolite batch, but there was little other information on variability. There was discussion of various limitations/sources of uncertainty. Plastic vials were used for sample collection, but samples were frozen right away, and the authors thought "there should be minimum interaction between the plastic vials and the biological content." |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Baek, K. M., Kim, M. J., Seo, Y. K., Kang, B. W., Kim, J. H., Baek, S. O. (2020). Spatiotemporal variations and health implications of hazardous air pollutants in Ulsan, a multi-industrial city in Korea. Atmosphere 11(5):547. |
| **HERO ID:** | 6950643 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling equipment and methods are described in sufficient detail, but certain aspects (e.g. duration of storage) were absent that are unlikely to have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | Medium | Analytical instrumentation and methods are described in excellent detail. However, method detection limits are only provided as a range across all analytes in each class. |
| | Metric 3: | Biomarker Selection | N/A | This study is testing for the parent chemical in an environmental medium. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Ulsan, Korea |
| | Metric 5: | Currency | Medium | 2009-2010 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Air samples were collected over eight days per season from five sampling sites for a total of 40 samples per season, but no replicate samples were collected. |
| | Metric 7: | Exposure Scenario | High | Each air sampling site is assigned either industrial or residential and thoroughly described in terms of surrounding buildings, traffic conditions, etc. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Raw data are not reported; so summary statistics can not be preproduced. Summary statistics include the mean and standard deviation for each sampling site. Supplemental information also provides mean and maximum concentrations for combined sites (industrial or residential). |
| | Metric 9: | Quality Assurance | High | QA/QC measures included uses of surrogate standards and internal standards, and recoveries for phthalates were within acceptable ranges (81.8%-99.5%). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Standard deviation is reported for each mean concentration. While there is some discussion of uncertainty and limitations, it focuses on health risk assessment subsequent to monitoring data and not the monitoring data itself. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Philips, E. M., Jaddoe, V. W. V., Deierlein, A., Asimakopoulos, A. G., Kannan, K., Steegers, E. A. P., Trasande, L. (2020). Exposures to phthalates and bisphenols in pregnancy and postpartum weight gain in a population-based longitudinal birth cohort. Environment International 144:106002. |
| **HERO ID:** | 6957398 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sample storage time was not specified. |
| | Metric 2: | Analytical Methodology | Medium | LOD was reported as a range for all phthalates. |
| | Metric 3: | Biomarker Selection | High | The biomarkers (metabolites of phthalates) are appropriate. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study population is from Rotterdam, Netherlands. Urine samples were transported to New York for analysis. |
| | Metric 5: | Currency | Medium | Samples were collected from 2004 to 2005. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Urine spot samples were collected. |
| | Metric 7: | Exposure Scenario | High | There is no clear exposure scenario, but this is a biomonitoring study among pregnant and postpartum women. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual raw data were not reported in the main study. However, in a large cohort study like this, providing raw data might not be feasible. |
| | Metric 9: | Quality Assurance | Low | Quality control measures were not discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study includes a discussion of its strengths and limitations. Characterization of variance only for maternal weight gain but not metabolite concentrations measured in urine. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Zhang, Z. M., Zhang, J., Zhang, H. H., Shi, X. Z., Zou, Y. W., Yang, G. P. (2020). Pollution characteristics, spatial variation, and potential risks of phthalate esters in the water-sediment system of the Yangtze River estuary and its adjacent East China Sea. Environmental Pollution 265(PT A):114913. |
| **HERO ID:** | 6957439 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | provide details about sampling sites, equipment, and procedure (additional info in supplementary section) |
| | Metric 2: | Analytical Methodology | Medium | used GC-MS and report method detection limit/detection frequency |
| | Metric 3: | Biomarker Selection | N/A | environmental samples |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Yangtze River estuary and East China Sea |
| | Metric 5: | Currency | High | 2015 and 2017 |
| | Metric 6: | Spatial and Temporal Variability | High | 166 seawater samples and 56 sediment samples |
| | Metric 7: | Exposure Scenario | Medium | studying phthalates in water |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | report average concentrations (Table S3 in supplementary info) but no summary stats or individual sample data |
| | Metric 9: | Quality Assurance | Medium | procedural standards and blanks used; most recoveries >75% |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | no measures of variance or uncertainty but interesting discussion about ecological risks |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Zhang, J., Yin, W., Li, P., Hu, C., Wang, L., Li, T., Gao, E., Hou, J., Wang, G., Wang, X., Wang, L., Yu, Z., Yuan, J. (2019). Interaction between diet- and exercise-lifestyle and phthalates exposure on sex hormone levels. Journal of Hazardous Materials 369:290-298. |
| **HERO ID:** | 6957457 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some information missing such as what was urine stored in and blood sampling methods. |
| | Metric 2: | Analytical Methodology | Medium | Limited description of analytical methods, only equipment reported. LOD for each metabolite detailed. |
| | Metric 3: | Biomarker Selection | High | Biomarker is known to represent exposure to parent chemical. Metabolites are derived from parent chemical (MnBP, MBzP). |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | High | Sampling began in 2014, finished in 2015 |
| | Metric 6: | Spatial and Temporal Variability | Low | 106 study participants, 3 replicates. Spot sampling for urine. |
| | Metric 7: | Exposure Scenario | Medium | Characterized the population but not their relation to the source of exposure. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Results are shown as averages in seasons and odds ratios. |
| | Metric 9: | Quality Assurance | Medium | Limited QA/QC discussed. The recovery of the method ranged from 74.6% and 104.8%. Urinary levels of nine phthalate metabolites were corrected with the corresponding urinary creatinine concentrations. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability in seasons measured. Limitations not discussed. |
| **Overall Quality Determination** | | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | Lim, S. (2020). The associations between personal care products use and urinary concentrations of phthalates, parabens, and triclosan in various age groups: The Korean National Environmental Health Survey Cycle 3 2015-2017. Science of the Total Environment 742:140640. |
| **HERO ID:** | 6957474 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling procedure was described in details, including equipment, storage, population characters. |
| | Metric 2: | Analytical Methodology | High | Analytical procedure was described. HPLC–MS/MS was used. The limit of detections (LODs) of phthalate metabolites were reported to be 0.040 μg/L for MnBP and 0.141 μg/L for MECPP. |
| | Metric 3: | Biomarker Selection | High | Biomarker (metabolite) is derived from exposure to the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Korea |
| | Metric 5: | Currency | High | The KoNEHS Cycle 3was conducted during August 2015 to July 2017. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 5962 study participants were included in this study. No replicates. |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant exposure scenario. The sample information included the products used. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Supplementary or raw data are not reported, and therefore summary statistics cannot be reproduced. |
| | Metric 9: | Quality Assurance | High | The study applied quality assurance/quality control measures and all pertinent quality assurance information is provided in the data source or companion source. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Key uncertainties, limitations, and data gaps have been identified. |
| **Overall Quality Determination** | | | **High** | |

| | |
|---|---|
| **Study Citation:** | Tang, S., He, C., Thai, P., Vijayasarathy, S., Mackie, R., Toms, L. L., Thompson, K., Hobson, P., Tscharke, B., O'Brien, J. W., Mueller, J. F. (2020). Concentrations of phthalate metabolites in Australian urine samples and their contribution to the per capita loads in wastewater. Environment International 137:105534. |
| **HERO ID:** | 6957476 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling equipment and procedures were reported in the study. Some sampling methods not reported such as sampler calibration. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods were reported. The LOQ was reported. Recovery samples were reported. |
| | Metric 3: | Biomarker Selection | Medium | This study included an acceptable biomarker. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | This study was conducted in Southeast Queensland, Australia. |
| | Metric 5: | Currency | Medium | The samples were collected between 2012 to 2017. |
| | Metric 6: | Spatial and Temporal Variability | High | >10 samples were collected but there were no replicates. |
| | Metric 7: | Exposure Scenario | Medium | Specific sources of exposure were not well characterized in this study. This was a biomonitoring study so specific sources were not documented. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data in this study were not reported. |
| | Metric 9: | Quality Assurance | High | Key QA was reported in this study. Recovery samples were reported, controls were collected, etc. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No gaps or limitations were reported in this study. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Araki, A., Bamai, Y. A., Bastiaensen, M., Van den Eede, N., Kawai, T., Tsuboi, T., Miyashita, C., Itoh, S., Goudarzi, H., Konno, S., Covaci, A., Kishi, R. (2020). Combined exposure to phthalate esters and phosphate flame retardants and plasticizers and their associations with wheeze and allergy symptoms among school children. Environmental Research 183:109212. |
| **HERO ID:** | 6957526 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sample storage duration was not reported. The study cites a different published work for full details on sampling methodology. |
| | Metric 2: | Analytical Methodology | Low | The study reports little more than the type of instrumentation used and a description of how the LOQ was calculated. The study cites a different published work for full details on analytical methodology. |
| | Metric 3: | Biomarker Selection | High | Metabolite is derived from exposure to the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study was conducted among elementary school children inSapporo, Japan. |
| | Metric 5: | Currency | Low | No sampling date is provided, but a publication date is available. Also, the articles indicates (reference provided) that details on the collection of samples have been reported elsewhere. |
| | Metric 6: | Spatial and Temporal Variability | Medium | The study is not clear if urine samples were 24 hrs samples collected (vs first morning). |
| | Metric 7: | Exposure Scenario | Medium | The study did not discussed product/chemical use in the building or building characteristics. The article often cites that details on collection of samples were reported in other studies. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data points were not reported. Several summary statistics were reported, including min, 25th percentile, 50th percentile, 75th percentile, and max. |
| | Metric 9: | Quality Assurance | Low | Urine sample specific gravity and osmolality were not reported. Quality control/quality assurance was not discussed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The study includes a discussion of its limitations. No measure of variance is reported. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Li, Y. L., Lv, J., Du, Z. P., Feng, S., Sheng, J., Jin, Z. X., Liu, K. Y., Gao, H., Li, X. D., Cao, H. J., Yang, L. S., Xu, D. X., Tao, F. B., Wang, Q. N. (2020). The levels of phthalate exposure and associations with obesity in an elderly population in China. Ecotoxicology and Environmental Safety 201:110749. |
| **HERO ID:** | 6957578 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Study population selection detailed but only brief description on collection of urine sample which is primary media of interest. |
| | Metric 2: | Analytical Methodology | Medium | Analytical methods described with more detail in cited study Gao et al. 2015. Reported LOD |
| | Metric 3: | Biomarker Selection | High | Biomarker is known to be related to external exposure |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | High | Sampling in 2016 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 942 samples, no replicates |
| | Metric 7: | Exposure Scenario | Medium | Limited discussion of relation to exposure source |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics |
| | Metric 9: | Quality Assurance | High | Analyzed control samples, discussed QA/QC techniques |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | discussed study limitations and uncertainties, didn't characterize variability |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Sol, C. M., Santos, S., Duijts, L., Asimakopoulos, A. G., Martinez-Moral, M. P., Kannan, K., Jaddoe, V. W. V., Trasande, L. (2020). Fetal phthalates and bisphenols and childhood lipid and glucose metabolism: A population-based prospective cohort study. Environment International 144:106063. |
| **HERO ID:** | 6957607 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling equipment and methods are only briefly mentioned, and missing details may have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | Low | Analytical instrumentation and methods are cited to an external source and very little detail is provided. LOD is reported in supplementary information. |
| | Metric 3: | Biomarker Selection | High | The monoester phthalate biomarker is a metabolite of just the chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The Netherlands |
| | Metric 5: | Currency | Low | 2004-2005 |
| | Metric 6: | Spatial and Temporal Variability | Medium | Pooled urine spot samples from757 participants at three timepoints |
| | Metric 7: | Exposure Scenario | High | The exposure scenario of fetuses during gestation is highly relevant |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Raw data are not reported; summary statistics include percentage below LOD, median, and percentiles (25, 75) of concentration. |
| | Metric 9: | Quality Assurance | Low | Quality assurance/quality control techniques and results were not directly discussed, but can be implied through the study's use of standard laboratory protocols |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No characterization of variation of results was reported, and limitations/sources of uncertainty are only briefly discussed. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Bach, C., Rosin, C., Munoz, J. F., Dauchy, X. (2020). National screening study investigating nine phthalates and one adipate in raw and treated tap water in France. Environmental Science and Pollution Research International 27(29):36476-36486. |
| **HERO ID:** | 6957772 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Raw and treated water from surface water and groundwater collected from 101 departments; collected twice n glass vials; immediately wrapped in aluminum foil and capped; stored at 4C before analysis; detailed sampling protocol in Fig S1; no pretreatment for treated water, but raw water was centrifuged. |
| | Metric 2: | Analytical Methodology | High | Extraction, analytical instrument (SPE-LC-MS/MS), calibration solutions, internal standard calibration, recoveries described. LOQ provided Table 2. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | France |
| | Metric 5: | Currency | High | November 2015-July 2016 |
| | Metric 6: | Spatial and Temporal Variability | High | 101 sites (271 raw water samples and 283 treated samples); collected twice in single sampling campaign. |
| | Metric 7: | Exposure Scenario | High | Concentration in raw and treated drinking water throughout France. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Table 4 provides concentration in raw water (surface water and ground water) and tap water (from surface water, groundwater, and mixture of the two); n, DF, max, average. |
| | Metric 9: | Quality Assurance | High | QA described in detail. Recoveries provided in Table 3; field blanks described. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Compared between tap and raw water; compared results to previous studies. No limitations reported. |
| **Overall Quality Determination** | | | **High** | |

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|---|---|
| **Study Citation:** | England-Mason, G., Grohs, M. N., Reynolds, J. E., Macdonald, A., Kinniburgh, D., Liu, J., Martin, J. W., Lebel, C., Dewey, D. (2020). White matter microstructure mediates the association between prenatal exposure to phthalates and behavior problems in preschool children. Environmental Research 182:109093. |
| **HERO ID:** | 6958936 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methods are described in moderate detail, but certain aspects (e.g. duration of storage, time of day of collection) were not reported; these are unlikely to have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | Medium | Analytical instrumentation and methods were described in detail, and the LODs were reported. It's unclear if it is standard practice to operate the so-called QTRAP equipment in "negative multiple reaction monitoring (MRM) mode, [with] the detection and quantification of metabolites [being] based on two MRM transitions combined with the retention time." Assigned it medium since neither calibration nor recoveries were reported. |
| | Metric 3: | Biomarker Selection | Low | Metabolites of parent chemicals were measured in urine. However, one of the metabolites could have come from multiple parent chemicals, including this one. No effort was made to apportion the estimate to each chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Canada |
| | Metric 5: | Currency | Medium | Maternal urine samples were taken during pregnancy from mothers of children who were ages 3-5 from 2013-2017; therefore, urine samples were collected sometime between 2008-2014 (not otherwise specified). It should be noted that the study also collected information about the white matter microstructure in children's brains and childhood behavior problems, reporting on potential association between these characteristics and phthalate exposure as a fetus. |
| | Metric 6: | Spatial and Temporal Variability | Low | One spot urine sample was collected per participant (76), without the use of replicates. Rated low because it appears each was an unpooled spot sample. |
| | Metric 7: | Exposure Scenario | Medium | Urinary metabolites are likely a good indicator of relative exposure of fetuses to maternal blood during gestation. A detailed questionnaire with information about potential sources of exposure to phthalates was not used, but these chemicals are ubiquitous. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data points are not reported; summary statistics include the percentage of samples above LOD, minimum, maximum, percentiles (25th, 50th, 75), and the median molar concentration. |
| | Metric 9: | Quality Assurance | Medium | QC "experiments using liquid chromatography grade water as a surrogate for urine (n = 20 control samples) did not find any contamination during collection, storage, and/or analysis." No other QA/QC techniques and results (e.g., recoveries) were directly discussed, but others may have been used given the study's use of standard field and laboratory protocols. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | The only information on variability is embedded in the data on percentiles. There was some discussion of limitations (e.g., the small sample size) and sources of uncertainty, most of them related to the study of white matter microstructure and reporting of child behavior. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Song, J., Lu, S., Wu, Y., Zhou, C., Li, X., Li, J. (2020). Migration and distribution characteristics of organic and inorganic fractions in condensable particulate matter emitted from an ultralow emission coal-fired power plant. Chemosphere 243:125346. |
| **HERO ID:** | 6959325 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | Sampling equipment and methods are briefly described, but most details are missing which may have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | Low | Analytical instrumentation and methods are briefly described, but most details are missing and no form of detection limit is reported. |
| | Metric 3: | Biomarker Selection | N/A | This study is testing for the parent chemical of interest in an environmental medium. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | Low | Paper was published in 2019. The sampling date was not reported. |
| | Metric 6: | Spatial and Temporal Variability | Low | Single samples were collected from four sites, with no mention of replicates. |
| | Metric 7: | Exposure Scenario | Low | The sampling sites evaluate various stages of a coal-fired power plant, but it is unclear if there are later steps in the system prior to any likely exposure. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Critically Deficient | Data are only reported in the form of total concentration for all phthalate, the identity of the detected phthalates, and the percentage of phthalates that were not DBP. While the concentration for DBP can be determined from this, the calculated value might be highly uncertain without more precise information. |
| | Metric 9: | Quality Assurance | Medium | QA/QC measures described include determination of linearity and recovery rate, both of which were within acceptable levels, but the methods by which these were determined were not described. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | No characterization of variability is presented and there is no discussion of limitations or sources of uncertainty. |

## Overall Quality Determination — Uninformative

| | |
|---|---|
| **Study Citation:** | Lee, Y. S., Lee, S., Lim, J. E., Moon, H. B. (2019). Occurrence and emission of phthalates and non-phthalate plasticizers in sludge from wastewater treatment plants in Korea. Science of the Total Environment 692:354-360. |
| **HERO ID:** | 6959335 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Most sampling information provided, such as site information, storage conditions and methods. However, missing the equipment used to collected the sludge. |
| | Metric 2: | Analytical Methodology | High | Analytical methods, instrument, calibration reported. LOQ reported in table S4. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical in environmental sample. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | South Korea |
| | Metric 5: | Currency | Medium | Samples collected in 2011. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 40 samples. No replicates. |
| | Metric 7: | Exposure Scenario | High | Measuring phthalates in sludge from WWTP. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not provided. Summary statistics (mean, range) provided in table 1. |
| | Metric 9: | Quality Assurance | High | Procedural blanks and recovered detailed. All recoveries, except DMP above 70%. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | There is comparison of different types of WTTP. Gaps and limitations not reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Schmidt, N., Castro-Jimenez, J., Fauvelle, V., Ourgaud, M., Sempere, R. (2020). Occurrence of organic plastic additives in surface waters of the Rhone River (France). Environmental Pollution 257:113637. |
| **HERO ID:** | 6966453 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology was well described, including sampling procedure, sampling storage, study site characteristics. |
| | Metric 2: | Analytical Methodology | Medium | Analytical methodologies were well described. LOQ range was reported in paper, all LODs and LOQs may be reported in SI. |
| | Metric 3: | Biomarker Selection | N/A | The analyte was measured in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected from the Rhone River, France. |
| | Metric 5: | Currency | High | Samples were collected from May 2017 to April 2018. |
| | Metric 6: | Spatial and Temporal Variability | High | Samples were collected in duplicate over the course of a year. |
| | Metric 7: | Exposure Scenario | High | Site and potential sources were well characterized. Data represented exposure to anyone who comes into contact with these rivers. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. Several summary statistics were reported, including min, max, median, mean, and standard deviation. |
| | Metric 9: | Quality Assurance | High | The study applied quality assurance measures and no issues were identified. Recovery rates were reported for individual analytes. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | The study characterized variability, fluxes, and other sources to the Rhone River. The study described other potential sources that might result in underestimation of the concentrations of analytes in the river. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Heo, H., Choi, M., Park, J., Nam, T., Cho, J. (2020). Anthropogenic occurrence of phthalate esters in beach seawater in the Southeast Coast Region, South Korea. Water 12(1):122. |
| **HERO ID:** | 6966475 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Some aspects of sampling methodology not described, such as sample storage time, coordinates from which samples were collected, and distance from the shoreline where surface water was collected. |
| | Metric 2: | Analytical Methodology | Low | They reported LOO and recoveries. While well-described, it is not clear how well-accepted the analytical method was: they used stirbar sorptive extraction (SBSE) and thermal desorption (TD), an extraction method for organic chemicals in a liquid matrix involving stirring with a polydimethylsiloxane-coated stir bar. The stir bar is inserted directly into the extraction of the TD unit. The TD unit desorbs extracted compounds in the stir bar by heating, concentrates the desorbed compounds, and injects the concentrate into a GC/MS. However, the National Institute of Environmental Research of Korea suggests another standard method for phthalate ester determination, and the paper to which the method is cited calls it "a novel extraction technique." In addition, method validation is not described. |
| | Metric 3: | Biomarker Selection | N/A | Samples were from environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | South Korea |
| | Metric 5: | Currency | High | Sampling was in 2017-2018. |
| | Metric 6: | Spatial and Temporal Variability | Critically Deficient | Total number of samples is not reported: there were 5 beaches, each sampled in spring and summer. In the case of at least one beach, samples were collected from both ends and the middle. One site underwent additional sampling in the spring before and after a rainstorm. No replicates were reported. |
| | Metric 7: | Exposure Scenario | Medium | Description of the timing of the collection of the samples is vague, and inclusion of more climate data would have made the results more meaningful. Sample size could impact the characterization of the exposure scenario. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | No raw data reported, and absent are mean detections, standard deviations, and ranges of most individual chemicals detected. IN most cases, summaries of data collected are reported on figures from which only approximate values for the levels of individual chemicals detected can be estimated. One exception was values of some individual chemicals reported at one beach from which three samples were collected. |
| | Metric 9: | Quality Assurance | Critically Deficient | Discussion of QA/QC was absent, making it impossible to assess reliability of the data. Control samples were not analyzed. Also, recoveries were 13.5%, 46.7%, 136.0%, and 102.0% for DMP, DEP, DnBP, and DEHP, but they did not correct for recovery. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Uncertainties, limitations and data gaps were not discussed at all. |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Qian, X.,i, Li, J., Xu, S., Wan, Y., Li, Y., Jiang, Y., Zhao, H., Zhou, Y., Liao, J., Liu, H., Sun, X., Liu, W., Peng, Y., Hu, C., Zhang, B.,in, Lu, S.,hi, Cai, Z., Xia, W.,ei (2019). Prenatal exposure to phthalates and neurocognitive development in children at two years of age. Environment International 131:105023. |
| **HERO ID:** | 6967437 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling methodology is adequately described and generally appropriate. Discussion does not include every detail, e.g. duration of sample storage, but this is unlikely to have a substantial impact on results. |
| | Metric 2: | Analytical Methodology | Medium | Analytical methodology is detailed in a separate reference, and limits of detection are provided in supplemental materials. |
| | Metric 3: | Biomarker Selection | Low | MBP is specific to DBP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Hubei Province, China. |
| | Metric 5: | Currency | Medium | Samples were collected in 2014-2015. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Urine spot samples were collected at multiple timepoints throughout pregnancy |
| | Metric 7: | Exposure Scenario | Medium | Study population is likely representative of mother-child pairs. This is a biomonitoring study were children are exposed in-utero and mothers are exposed due to widespread use of phthalates. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Individual data points were not reported. |
| | Metric 9: | Quality Assurance | High | QC measures included analysis of blanks and QC samples alongside batch samples. Within-batch and between-batch coefficients of variation were 9.9% and 13.7%, respectively. Specific gravity was accounted for. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | There was a limited characterization of variance and a brief discussion of study limitations, including the use of averaging across urine spots instead of a measurement error model. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Bartsch, P. W., Edwards, T. M., Brock, J. W. (2019). Prevalence of eight phthalate monoestersin water from the Okavango Delta, Northern Botswana. Bulletin of Environmental Contamination and Toxicology 103(2):274-279. |
| **HERO ID:** | 6968214 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key methods reported. Site characteristics, sampling equipment, method, and storage described. More information referenced in (Blount 2000; Silva 2010). |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported. Methods, equipment (LCMS-8040 and HPLC column), calibration, and LOD reported. |
| | Metric 3: | Biomarker Selection | Medium | Metabolites measured in water samples. It is not mentioned that these biomarkers are derived from the parent chemical of interest. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Botswana |
| | Metric 5: | Currency | High | Samples collected in 2016 |
| | Metric 6: | Spatial and Temporal Variability | Medium | 46 samples no replicates |
| | Metric 7: | Exposure Scenario | High | Samples taken from The Okavango Delta, where there is wildlife and human activity that can be exposed. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not reported. Average, range, and highest levels reported for each metabolite. |
| | Metric 9: | Quality Assurance | Medium | Little QA discussion but there were sample controls and recovery. Concentrations were corrected for original sample volumefrom field records. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability in different sites reported and comparison of concentrations to other bodies of water. SD was mentioned to be calculated but not reported in study. Few gaps and limitations reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Shin, H., Moschet, C., Young, T. M., Bennett, D. H. (2019). Measured concentrations of consumer product chemicals in California house dust: Implications for sources, exposure, and toxicity potential. Indoor Air 30(1):60-75. |
| **HERO ID:** | 6968217 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Method for recruiting the 38 households not explained. |
| | Metric 2: | Analytical Methodology | High | Standard LC and GC protocols were described and LODs were reported. |
| | Metric 3: | Biomarker Selection | N/A | Testing for the parent chemical in an environmental media |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Northern California. |
| | Metric 5: | Currency | High | Samples were collected in 2015-2016. |
| | Metric 6: | Spatial and Temporal Variability | Medium | No replicates were reported among 38 samples. |
| | Metric 7: | Exposure Scenario | Medium | Limited information on chemical use. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. Summary statistics were reported. |
| | Metric 9: | Quality Assurance | Low | No discussion of QA/QC although standard protocols were used. No discussion of recoveries. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Some uncertainties and limitations are discussed in the section entitled ”Overview and scope of this study”. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Borges Ramirez, M. M., Dzul Caamal, R., Rendon von Osten, J. (2019). Occurrence and seasonal distribution of microplastics and phthalates in sediments from the urban channel of the Ria and coast of Campeche, Mexico. Science of the Total Environment 672(Elsevier):97-105. |
| **HERO ID:** | 6968287 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sediments were collected at 5cm depth from surface layer with van Veen grab, placed in aluminum foil, wrapped in black bags, and stored in refrigerator/freezer. They were then thawed, dried in an oven at 45C for 24 h, grounded in a mortar, and sieved. Sample sites are provided in Fig 1 and Table 1. The number of samples per site was not provided. |
| | Metric 2: | Analytical Methodology | High | Extraction done using a microwave oven (p.99-100). Samples were analyzed with GC-FID. Recoveries and LODs (0.015ug/g) were reported in text. |
| | Metric 3: | Biomarker Selection | N/A | The study measured parent chemicals in sediment. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Campeche, Mexico. |
| | Metric 5: | Currency | High | Samples were collected from 2015-2017. |
| | Metric 6: | Spatial and Temporal Variability | Medium | 36 samples were collected from nine sites over three different seasons (rainy, cold, and dry (Table 1)). No replicates were reported. |
| | Metric 7: | Exposure Scenario | High | Study measured concentrations and seasonal distribution in coastal sediment and in urban and natural drainage system, which is relevant because of its proximity to urban settlements. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Fig 6 provides concentration at each site graphically. Some exact concentration data are provided in text. No other results are available. |
| | Metric 9: | Quality Assurance | High | QC was reported, including blanks and recoveries that ranged from 85-103%. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Authors discussed variation by sites and compared results to those from previous studies and different countries, but did not characterize data variance. There was no discussion of uncertainties or limitations. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Kim, K., Kim, H., Lim, Y., Shin, C. H.,o, Kim, J. I., Kim, B. N., Lee, Y. A.,h, Hong, Y. (2020). Prenatal and early childhood phthalate exposures and thyroid function among school-age children. Environment International 141:105782. |
| **HERO ID:** | 6968345 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Sampling equipment and methods are sufficiently described but are missing some details (e.g. duration of storage) that are unlikely to have a substantial impact on results |
| | Metric 2: | Analytical Methodology | High | Analytical instrumentation and methods are sufficiently described and LOD is reported. |
| | Metric 3: | Biomarker Selection | Medium | Biomarkers are derived from multiple parent chemicals, not only the chemical of interest, and there is NOT a stated method to apportion the estimate to only the chemical of interest |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Korea |
| | Metric 5: | Currency | Medium | 2012-2015 |
| | Metric 6: | Spatial and Temporal Variability | Medium | n = 492. No replicates. Pooled urine spot samples were used in this study for during pregnancy and at ages 2, 4, and 6 years. All samples were collected between 9-11 am, but only one sample at each developmental timepoint. |
| | Metric 7: | Exposure Scenario | Medium | Prenatal and early childhood phthalate exposures and thyroid function among children. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Summary statistics for biomarker concentration include geometric mean, geometric standard deviation, and percentiles (5th, 25th, 50th, 75th, 95th). Individual data points are not reported. |
| | Metric 9: | Quality Assurance | Medium | The study reported use of assurance/quality control measures (blank, spike); however, results of those measures were not described. Missing information is unlikely to have a substantial impact on results |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Metrics of variance did not reveal any high uncertainty. Authors acknowledge limitations in their study including short half-lives of analyzed metabolites |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Feng, Y. L., Liao, X. J., Chen, D., Takser, L., Cakmak, S., Chan, P., Zhu, J. P. (2020). Correlations of phthalate metabolites in urine samples from fertile and infertile men: Free-form concentration vs. conjugated-form concentration. Environmental Pollution 263(Pt. A):114602. |
| **HERO ID:** | 6968351 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Demographics of participants, storage, and collection procedures were explained but missing some information on duration of storage and collection equipment. |
| | Metric 2: | Analytical Methodology | High | Detailed analytical methods with LOD reported in supplementary information. |
| | Metric 3: | Biomarker Selection | High | MBzP is specific to BBP. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Study conducted in Canada. |
| | Metric 5: | Currency | Medium | Sampling was conducted in 2009-2012. |
| | Metric 6: | Spatial and Temporal Variability | Low | A single urine sample was collected from each of 150 participants without replicates. |
| | Metric 7: | Exposure Scenario | High | This is a biomonitoring study were exposure was presumed to occur through phthalates' ubiquity in consumer products. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics were reported (i.e., no raw data). |
| | Metric 9: | Quality Assurance | High | QA/QC techniques were reported in detail. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variance was characterized with percentiles, and some limitations were reported in the conclusions. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Yue, N., Deng, C., Li, C., Wang, Q.,i, Li, M., Wang, J., Jin, F. (2020). Occurrence and distribution of phthalate esters and their major metabolites in porcine tissues. Journal of Agricultural and Food Chemistry 68(25):6910-6918. |
| **HERO ID:** | 6968617 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Critically Deficient | The sampling methodology is not discussed. Only information given is 16 pigs from a livestock farm in Shangzhuang village, Beijing. |
| | Metric 2: | Analytical Methodology | Medium | LOD and LOQ range provided; instrumentation described; recovery rates in SI |
| | Metric 3: | Biomarker Selection | High | parent and metabolite in pig tissues |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | China |
| | Metric 5: | Currency | High | 2017 |
| | Metric 6: | Spatial and Temporal Variability | High | 16 pigs: Three samples were taken from each of thesix types of porcine tissue samples (liver, heart, kidney, muscle, spleen, and lungs) |
| | Metric 7: | Exposure Scenario | Medium | livestock farm |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | average reported; SD or SE not specified |
| | Metric 9: | Quality Assurance | Medium | blanks, recovery described in QA/QC section |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | variability and uncertainty not discussed; no obvious concerns |

## Overall Quality Determination Uninformative

| | |
|---|---|
| **Study Citation:** | Zhang, B. T., Gao, Y. M., Lin, C. Y., Yang, W., Liu, T., Liu, X. T., Wang, Y. (2020). Spatial distribution of phthalate acid esters in sediments of the Laizhou Bay and its relationship with anthropogenic activities and geochemical variables. Science of the Total Environment 722:137912. |
| **HERO ID:** | 6968622 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported |
| | Metric 2: | Analytical Methodology | High | Key analytical methods reported. LOD reported in supplemental. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Laizhou Bay, China |
| | Metric 5: | Currency | High | Samples collected in 2018 |
| | Metric 6: | Spatial and Temporal Variability | High | >10 samples; there is mention of duplicate samples. |
| | Metric 7: | Exposure Scenario | High | Statistical analyses that characterize exposure scenario |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data not provided. Summary statistics reported. |
| | Metric 9: | Quality Assurance | High | Key QA reported and in supplemental. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Limited gaps and limitations reported. There is discussion of variation. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Kıralan, S. S., Toptancı, I., Abacıgil, T. O., Ramadan, M. F. (2020). Phthalates levels in olive oils and olive pomace oils marketed in Turkey. Food Additives & Contaminants: Part A, Chemistry, Analysis, Control, Exposure & Risk Assessment 37(8):1332-1338. |
| **HERO ID:** | 6968889 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Key sampling methods reported. |
| | Metric 2: | Analytical Methodology | High | Key analytical methods provided. |
| | Metric 3: | Biomarker Selection | N/A | The study is testing for the parent chemical in oil olive samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Turkey |
| | Metric 5: | Currency | High | Samples collected in 2019. |
| | Metric 6: | Spatial and Temporal Variability | Medium | >10 samples; no replicates. |
| | Metric 7: | Exposure Scenario | Medium | Exposure source not well characterized. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Raw data provided. |
| | Metric 9: | Quality Assurance | Medium | Limited QA/QA reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Few gaps and limitations reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Henriksen, L. S., Mathiesen, B. K., Assens, M., Krause, M., Skakkebæk, N. E., Juul, A., Andersson, A. M., Hart, R. J., Newnham, J. P., Keelan, J. A., Pennell, C., Main, K. M., Frederiksen, H. (2020). Use of stored serum in the study of time trends and geographical differences in exposure of pregnant women to phthalates. Environmental Research 184:109231. |
| **HERO ID:** | 6968891 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Medium | Limited description of sampling methods. |
| | Metric 2: | Analytical Methodology | Medium | Limited description of anaytical methods, mentioned LOD but didn't report it. |
| | Metric 3: | Biomarker Selection | High | Metabolites are known to be related to external exposure. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Australia and Denmark |
| | Metric 5: | Currency | Low | Samples from 1997 to 2001, and 2012-2014. |
| | Metric 6: | Spatial and Temporal Variability | Low | 213 samples, no replicates. |
| | Metric 7: | Exposure Scenario | Medium | Missing discussion of relation to the source of exposure. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics. |
| | Metric 9: | Quality Assurance | Medium | Analyzed control samples, did not describe QA/QC techniques. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Did not characterize variability. Discussed uncertainties and study limitations. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Bohlin-Nizzetto, P., Aas, W., Nikiforov, V. (2019). Monitoring of Environmental Contaminants in Air and Precipitation, 2018. |
| **HERO ID:** | 6994279 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Air samples were collected using high volume air samplers. All important details were reported and the methodology was scientifically sound. |
| | Metric 2: | Analytical Methodology | Low | Samples were spiked with internal standards, extracted, and quantified using UPLC-MSMS. All important details were reported and the methodology is scientifically sound. However, while LOD and LOQ were referenced throughout the report, the specific values of these limits were not reported. |
| | Metric 3: | Biomarker Selection | N/A | This study was testing for the chemical of interest in environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in Norway. |
| | Metric 5: | Currency | High | Samples were collected in 2017-2018. |
| | Metric 6: | Spatial and Temporal Variability | Medium | Active air samples were collected over on a weekly basis over the course of a year. The number of samples per year was reported to be compound and site specific, between 12 and 52, but not explicitly reported for each compound. Further, use of replicates was not reported. |
| | Metric 7: | Exposure Scenario | High | Air samples were well characterized and highly relevant for possible exposure. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Raw data were not reported. Summary statistics included detection frequency and mean concentrations. |
| | Metric 9: | Quality Assurance | Medium | Analyses were carried out by NILU laboratories, which were accredited in accordance with NS-EN ISO/IEC 17025. QC measures included field and lab blank samples, but were not further explained. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability was characterized qualitatively over time. There was brief discussion of uncertainty inherent in the more newly developed procedures for "organic contaminants of emerging concern," but was not further explained. |

## Overall Quality Determination — Medium

**Study Citation:** Dong, C. D., Wang, M. H., Chen, C. F., Shih, Y. J., Chang, K. L., Lee, S. H., Lin, Y. L., Wu, C. H., Chen, C. W. (2020). Detecting phthalate esters in sludge particulates from wastewater treatment plants. Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 55(10):1233-1240.

**HERO ID:** 7976582

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology of dehydrated sludge samples and operating conditions of seven WWTPs were described thoroughly. The study included the sample collection equipment, procedures, and storage conditions. |
| | Metric 2: | Analytical Methodology | High | The analytical methodology was described in detail, including the extraction method, analytical instrumentation, calibration, and analytical method. Detection limits relative percent differences, and recoveries were reported in Table 3. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical was measured in sludge samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study samples were collected at WWTPs in southern Taiwan. |
| | Metric 5: | Currency | Low | The study did not provide a sample collection date, the publication date was 2020. |
| | Metric 6: | Spatial and Temporal Variability | Low | 1 kg of sludge was collected at each of the 7 WWTPs. No replicate samples were reported. It appears that samples were collected at one time, which does not account for spatial and temporal variability within the WWTP. |
| | Metric 7: | Exposure Scenario | Medium | The study provides concentrations in the wastewater sludge which is indicative of contamination in the environment that people could be exposed to prior to accumulation at the WWTP. However, more discussion could have been provided about sources of exposure. There was no use of exposure controls. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | The individual data points for the sample collected at each WWTP was reported in Table 4. There are not summary statistics reported. |
| | Metric 9: | Quality Assurance | High | Quality assurance and quality control were discussed including instrument calibration, detection limits, blanks, sample duplicates, and matrix spike standards. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variation of concentrations across the different WWTPs were discussed on p. 1236 and the concentrations in this study were compared across other studies. Limitations and uncertainties were not reported. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | McConnell, M. L. (2007). Distribution of phthalate monoesters in an aquatic food web. |
| **HERO ID:** | 10365669 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The environmental sampling methods were described in detail and are scientifically sound. |
| | Metric 2: | Analytical Methodology | High | The analytical methods were described, including LOD and recoveries. |
| | Metric 3: | Biomarker Selection | N/A | The author analyzed environmental media. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in Canada. |
| | Metric 5: | Currency | Medium | The samples were collected in 2005. |
| | Metric 6: | Spatial and Temporal Variability | High | n>10 samples (multiple environmental matrices). |
| | Metric 7: | Exposure Scenario | High | The data closely represent relevant exposure scenarios related to phthalates in water bodies in Canada. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Medium | Only summary statistics were reported (min, max, mean, SD). |
| | Metric 9: | Quality Assurance | High | QA/QC techniques were described in detail. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Medium | Variability was characterized (SD). Uncertainties and limitations were briefly discussed. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | WSDE, (2022). Chemicals of emerging concern in pretreated industrial wastewater in Northwestern Washington state: Screening study results, 2021. |
| **HERO ID:** | 11505405 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | The study reports a description of each of the study locations and sampling methods, including sampling materials, QC procedures and sample storage. |
| | Metric 2: | Analytical Methodology | High | The samples were analyzed using the EPA 8270E method. Detection and reporting limits are in appendix C. |
| | Metric 3: | Biomarker Selection | N/A | The parent chemical was measured in waste water. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study was conducted in the Puget Sound region of Washington State, USA. |
| | Metric 5: | Currency | High | The study was conducted from January to April 2021. |
| | Metric 6: | Spatial and Temporal Variability | Low | Although sample size not reported, sampling conducted in accordance with quality assurance project plan (QAPP) described in field methods section. Grab samples collected at each of the 9 facilities. |
| | Metric 7: | Exposure Scenario | High | The study evaluates concentrations in pretreated industrial wastewater in Washington state. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | Low | Raw data is not reported. Concentrations are reported in figure 5. |
| | Metric 9: | Quality Assurance | High | The study reported a series of field and laboratory quality control samples. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Study limitations are reported in page 39. There is not characterization of variability. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Wang, M. H., Chen, C. F., Albarico, F. P. J.,B, Chen, C. W., Dong, C. D. (2022). Occurrence and distribution of phthalate esters and microplastics in wastewater treatment plants in Taiwan and their toxicological risks. Chemosphere 307(Pt 2):135857. |
| **HERO ID:** | 11784627 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | Low | The study described the sources that the sludge samples were taken from but did not report sample equipment, sampling procedures, or sample storage conditions. |
| | Metric 2: | Analytical Methodology | High | Analytical methodology was thoroughly described, including the instrument calibration, analytical instrumentation, and extraction method, recovery samples, relative percent difference, and detection limits. MDLs are reported in Tables 1 and S4. |
| | Metric 3: | Biomarker Selection | N/A | Parent chemical was measured in sludge samples from wastewater treatment plants. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | The study area was western Taiwan. |
| | Metric 5: | Currency | Low | The study did not provide a sample collection date, the study was published in 2022. |
| | Metric 6: | Spatial and Temporal Variability | Low | The study collected between 3-8 samples for each type of treatment plant, locations are reported in Figure 1. No replicate samples were mentioned. Timeline of sample collection was also not reported. |
| | Metric 7: | Exposure Scenario | High | The authors discuss the potential for human exposure the chemical in soil after application of the sludge samples from WWTPs. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | The concentration of the sludge sample from each plant (n=17) and the MDL were reported in Table 1. |
| | Metric 9: | Quality Assurance | High | The study thoroughly describes QC measures including the use of a calibration curve, procedural blanks, check standard, sample duplicates, and certified reference materials. The ranges of recoveries and relative percent difference of sample duplicates are reported in text. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | Low | Variability in concentrations within each WWTP type were shown in box plots in Figure 4. They also performed a principal component analysis to explain the variability in concentrations based on the sludge basic properties in section 3.4. Limitations and uncertainties were not discussed. |
| **Overall Quality Determination** | | | **Medium** | |

| | |
|---|---|
| **Study Citation:** | Billings, A., Carter, H., Cross, R. K., Jones, K. C., Pereira, M. G., Spurgeon, D. J. (2023). Co-occurrence of macroplastics, microplastics, and legacy and emerging plasticisers in UK soils. Science of the Total Environment 880:163258. |
| **HERO ID:** | 11785155 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology | High | Sampling methodology for soil and plastic item collection was thoroughly described including sampling equipment, procedures, storage conditions, study site characteristics, and matrix characteristics. |
| | Metric 2: | Analytical Methodology | High | Analytical methodology was described in detail, including the soil digestion method, instrument calibration, analytical instrumentation, recovery samples, and limits of detection. Limits of detection are reported in Table 1 and Table S4. |
| | Metric 3: | Biomarker Selection | N/A | The parent chemical was measured in environmental soil samples. |
| Domain 2: Representativeness | | | | |
| | Metric 4: | Geographic Area | High | Samples were collected in central and southern England (UK). |
| | Metric 5: | Currency | High | Sampling took place in January and February of 2020. |
| | Metric 6: | Spatial and Temporal Variability | Medium | There were 3-7 samples for each different land use scenario, multiple samples were taken at each site and combined to account for spatial variation across the site. Samples were only collected one time |
| | Metric 7: | Exposure Scenario | Medium | Exposure to humans was not explicitly discussed. However, this is an environmental monitoring study where exposure to phthalates can occur through contaminated soil. Information regarding the microenvironment was provided. There was a use of exposure controls, using woodland soils that were expected to have minimal phthalate concentrations. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 8: | Reporting of Results | High | Results are reported in Table 2. Summary statistics are detailed and complete including mean, median, range, and detection frequency. |
| | Metric 9: | Quality Assurance | High | Quality assurance and quality control were described in detail including recoveries, blanks, positive controls, and microplastic control measures. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 10: | Variability and Uncertainty | High | Limitations and uncertainties are discussed in detail in section 3.3. Additionally, they discuss the limitation of a relatively small number of sampling sites. Variability was characterized using the range in Table 2. They also statistically examined the variation of different contaminants between land uses. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Bauer, M. J., Herrmann, R. (1997). Estimation of the environmental contamination by phthalic acid esters leaching from household wastes. Science of the Total Environment 208(1-2):49-57. |
| **HERO ID:** | 679229 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology and Conditions | High | The authors describe the sample collection and treament. |
| | Metric 2: | Analytical Methodology | Low | The authors describe the methods and equipment used for the analysis, but they do not include the LODs. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers were not used. |
| Domain 2: Representative | | | | |
| | Metric 4: | Testing Scenario | High | The testing conditions were appropriate for the chemical studied. |
| | Metric 5: | Sample Size and Variability | Medium | The authors mention that the values presented in Table 3 were based on six or nine extractions. |
| | Metric 6: | Temporality | Low | The time of sample collection was more than 15 years before the current year. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 7: | Reporting of Results | Medium | The authors present the mean (and minimum and maximum) in Table 3 but do not include the frequency of detection or measures of variation. |
| | Metric 8: | Quality Assurance | Medium | The authors asserted that they understood the need for careful attention to the issues of contamination during the sample handling and analysis processes. They claimed that blanks were monitored. They claimed that "recovery was complete," which I assumed meant 100%. In all cases, the authors did not provide the results (values) for the experiments. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 9: | Variability and Uncertainty | Medium | The authors identify some of the discrepancies between controlled laboratory experiments and real-world scenarios, and describe some of the reasons these differences are relevant. They could not provide numerical evidence that could be used to correct for the differences (although this is not a detriment to the study). |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Tsumura, Y., Ishimitsu, S., Kaihara, A., Yoshii, K., Nakamura, Y., Tonogai, Y. (2001). Di(2-ethylhexyl) phthalate contamination of retail packed lunches caused by PVC gloves used in the preparation of foods. Food Additives and Contaminants 18(6):569-579. |
| **HERO ID:** | 683035 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology and Conditions | High | Sampling methodology and conditions are clearly reported in the text. |
| | Metric 2: | Analytical Methodology | High | The analytical procedure and materials are reported, the study also reported the LOD. |
| | Metric 3: | Biomarker Selection | N/A | The study reports the parent chemical in gloves. |
| Domain 2: Representative | | | | |
| | Metric 4: | Testing Scenario | High | The study evaluates the migration of the chemical to food by the use of PVC gloves. |
| | Metric 5: | Sample Size and Variability | Low | Sample size is small but reported. |
| | Metric 6: | Temporality | Low | Material tested in 1999 |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 7: | Reporting of Results | Low | Weight fractions reported per each chemical. Raw data reported for the concentrations of chemicals in each glove. |
| | Metric 8: | Quality Assurance | High | The study reports techniques to follow QA/QC criteria. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 9: | Variability and Uncertainty | Low | Variability or uncertainty not reported for the gloves. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Mo, C. H., Cai, Q. Y., Li, Y. H., Zeng, Q. Y. (2008). Occurrence of priority organic pollutants in the fertilizers, China. Journal of Hazardous Materials 152(3):1208-1213. |
| **HERO ID:** | 1003896 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology and Conditions | High | Fertilizer samples collected from Chinese factories and companies; Sample extraction following USEPA methods 3540C and 3630C with some modifications, explained in the study |
| | Metric 2: | Analytical Methodology | High | GCMS analysis with modified USEPA 8270C method, all instrumentation details and detection limits provided |
| | Metric 3: | Biomarker Selection | N/A | Biomarker not used |
| Domain 2: Representative | | | | |
| | Metric 4: | Testing Scenario | Medium | Exposure to chemicals in fertilizers may be reasonable consumer scenario, but the fertilizers tested were selected due to their wide use in China rather than USA |
| | Metric 5: | Sample Size and Variability | High | 22 samples of fertilizers |
| | Metric 6: | Temporality | Medium | Study from 2007, no indication of samples or fertilizers being older |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 7: | Reporting of Results | Medium | Concentration by weight reported for each chemical for all samples; some summary data in text |
| | Metric 8: | Quality Assurance | Low | Recoveries reported; QA/QC procedures discussed as being presented in previous studies |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 9: | Variability and Uncertainty | Low | Limited discussion on variability in fertilizers and detected concentrations; no real discussion on uncertainties |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Fierens, T., Vanermen, G., Van Holderbeke, M., De Henauw, S., Sioen, I. (2012). Effect of cooking at home on the levels of eight phthalates in foods. Food and Chemical Toxicology 50(12):4428-4435. |
| **HERO ID:** | 1311695 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology and Conditions | Medium | Sampling methodology appears reasonable, but is not described in full detail. |
| | Metric 2: | Analytical Methodology | Medium | Analytical procedure refers back to a previous study (Fierens et al., 2012). Analysis seems to have been performed using GC-EI-MS. LOQs are reported in Section 2.4. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers are not used in this study; phthalate levels are assessed directly. |
| Domain 2: Representative | | | | |
| | Metric 4: | Testing Scenario | Medium | The experiment is designed to mimic typical home-cooking procedures and equipment. General environmental conditions are not described. |
| | Metric 5: | Sample Size and Variability | High | Fifteen foods were sampled. Each sample was taken in duplicate. |
| | Metric 6: | Temporality | Medium | Data was collected in 2011, between 5 and 15 years ago. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 7: | Reporting of Results | Medium | Raw data is reported, but summary statistics are minimal. |
| | Metric 8: | Quality Assurance | Low | There is no specific discussion of QA/QC procedures, but also no indication of issues. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 9: | Variability and Uncertainty | Low | There is no specific discussion of variability or uncertainty. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Dodson, R. E., Nishioka, M., Standley, L. J., Perovich, L. J., Brody, J. G., Rudel, R. A. (2012). Endocrine disruptors and asthma-associated chemicals in consumer products. Environmental Health Perspectives 120(7):935-943. |
| **HERO ID:** | 1325358 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology and Conditions | Low | Sampling methodology explained but not from an authoritative or referenced source. Choose to use composite samples (mixed different sources to make one average product). |
| | Metric 2: | Analytical Methodology | High | Analytical methods described and appear scientifically sound. LOD and additional information in the supplemental file. |
| | Metric 3: | Biomarker Selection | N/A | Tested consumer products. |
| Domain 2: Representative | | | | |
| | Metric 4: | Testing Scenario | High | Data likely to represent relevant exposure from alternative products. |
| | Metric 5: | Sample Size and Variability | Medium | Number of products used to make "composite" product ranged from 1-8; 27 different products tested; included duplicate samples. |
| | Metric 6: | Temporality | Medium | Tested products from between 5-10 years ago. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 7: | Reporting of Results | Medium | Raw data not reported - exact concentrations remain unknown. |
| | Metric 8: | Quality Assurance | High | QA/QC described (details in supplemental file). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 9: | Variability and Uncertainty | High | Discussion included on variability and uncertainty. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Grynkiewicz-Bylina, B. (2011). Dangerous phthalates in children's environment. Ecological Chemistry and Engineering S 18(4):455-463. |
| **HERO ID:** | 1325712 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology and Conditions | Low | Sampling methodology described but not in detail or in accordance with authoritative source or widely accepted guidelines; samples cut from toys/articles and fragmented using cryogenic mill before extraction view Soxhlet method using dichloromethane. |
| | Metric 2: | Analytical Methodology | Medium | Analytical methodology described (GC-MS) including calibration and calculations needed for unit conversions; LOD for concentration 0.05% |
| | Metric 3: | Biomarker Selection | N/A | Biomarker not used. |
| Domain 2: Representative | | | | |
| | Metric 4: | Testing Scenario | Low | Samples collected under one set of conditions; also unclear where the toys were collected (no name brands, for example, to verify their use and composition). |
| | Metric 5: | Sample Size and Variability | High | Total of 228 products tested (172 toys, 56 articles) further divided into type of material; two samples per product. |
| | Metric 6: | Temporality | Medium | Toys and articles sampled in 2009-2011, may not represent current market products. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 7: | Reporting of Results | Low | Raw concentration data reported with uncertainty at 95% confidence level; no summary statistics. |
| | Metric 8: | Quality Assurance | Low | QA/QC techniques not directly discussed but inference of some based on calibration in analytical procedures. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 9: | Variability and Uncertainty | Medium | Variability in types of products sampled and distinction of products vs articles; uncertainty measures included in data reporting for each chemical and type of material. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Llompart, M., Sanchez-Prado, L., Pablo Lamas, J., Garcia-Jares, C., Roca, E., Dagnac, T. (2013). Hazardous organic chemicals in rubber recycled tire playgrounds and pavers. Chemosphere 90(2):423-431. |
| **HERO ID:** | 1597738 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology and Conditions | Medium | Sampling procedure described in general terms, and appears to be reasonable. |
| | Metric 2: | Analytical Methodology | High | Analytical methodology is described in detail. Analysis performed using GC-MS. Instrumental detection limits are included in Table 1. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers are not used in this study. |
| Domain 2: Representative | | | | |
| | Metric 4: | Testing Scenario | Medium | Section 3.4 discusses the connection between laboratory conditions and potential real-world scenarios. |
| | Metric 5: | Sample Size and Variability | Low | 17 samples were taken from playground locations and 7 purchased commercially. No indication of replicates being used. |
| | Metric 6: | Temporality | Medium | Based on publication information, data can be assumed to be between 5 and 15 years old. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 7: | Reporting of Results | Medium | Raw data is not reported, but summary statistics are relatively complete. |
| | Metric 8: | Quality Assurance | Medium | Quality control procedures are mentioned briefly. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 9: | Variability and Uncertainty | Low | There is no specific discussion of variability or uncertainty in the results. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Ionas, A. C., Dirtu, A. C., Anthonissen, T., Neels, H., Covaci, A. (2014). Downsides of the recycling process: Harmful organic chemicals in children's toys. Environment International 65:54-62. |
| **HERO ID:** | 2345985 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology and Conditions | Medium | Sampling methodology described in detail but not citation provided for publicly available or accepted SOPs or guidelines |
| | Metric 2: | Analytical Methodology | High | GCMS methodology discussed in detail, with LOQs provided and recovery samples |
| | Metric 3: | Biomarker Selection | N/A | Biomarker not used |
| Domain 2: Representative | | | | |
| | Metric 4: | Testing Scenario | High | Exposure from toys is a relevant scenario, and the delineation of material type, year of production, country of production allow for more nuanced consideration of data |
| | Metric 5: | Sample Size and Variability | Medium | Sample size varies by chemical group and is divided by sample type (hard plastic, wood, etc.); n=50 for phthalates and n=114 for PFRs |
| | Metric 6: | Temporality | Medium | Study published in 2014 but the production year of the toys sampled ranges from 1993 to 2012 |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 7: | Reporting of Results | Medium | Detection frequency, median, 90th%, and maximum concentration reported by chemical in study; median, mean, and max reported by exposure time and exposure pathway in supplemental file |
| | Metric 8: | Quality Assurance | High | Reference materials used and accuracy and precision results reported for the methods used; full method validation writeup in supplemental file |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 9: | Variability and Uncertainty | Medium | Uncertainty discussed in exposure potential; variability addressed through toy types and correlation considerations by different parameters |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Jeon, S., Kim, K., Choi, K. (2016). Migration of DEHP and DINP into dust from PVC flooring products at different surface temperature. Science of the Total Environment 547(Elsevier):441-446. |
| **HERO ID:** | 3222272 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology and Conditions | Medium | Sampling methodology clearly described with equipment and conditions (in small chamber and FLEC). |
| | Metric 2: | Analytical Methodology | Medium | Analytical methods clearly described for identifying phthalates in flooring (soxhlet extraction and GC/MS), migration testing (auto thermal adsorber and GC/MS), and analysis in dusts (GC/MS). Generic detection limit provided for chemicals not detected. |
| | Metric 3: | Biomarker Selection | N/A | Biomarker not used. |
| Domain 2: Representative | | | | |
| | Metric 4: | Testing Scenario | Medium | Environmental conditions reflect scenario of interest (home environment) but the flooring samples are from the Korean market and may not reflect US materials. |
| | Metric 5: | Sample Size and Variability | Low | Four types of PVC flooring sampled, two coated with UV curing paint, one coated with wax, and one not coated; one sample for each chemical for each surface. |
| | Metric 6: | Temporality | High | Flooring samples collected for study in 2016, likely temporally relevant (5 years). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 7: | Reporting of Results | Low | Single concentration data provided in flooring samples and dust; no summary statistics. |
| | Metric 8: | Quality Assurance | Medium | Concentrations compared to measured values from multiple studies; recovery samples for dust measurements reported (97+/ 9 and 122+/30). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 9: | Variability and Uncertainty | Medium | Limited variability in flooring samples, limited variability in temperature (heating vs not). |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Negev, M., Berman, T., Reicher, S., Sadeh, M., Ardi, R., Shammai, Y. (2018). Concentrations of trace metals, phthalates, bisphenol A and flame-retardants in toys and other children's products in Israel. Chemosphere 192(Elsevier):217-224. |
| **HERO ID:** | 4285931 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology and Conditions | Low | Sampling methodology is described only in broad terms. |
| | Metric 2: | Analytical Methodology | Medium | The analytical method is not given in detail but is cited as an EU standard, and uses GC-MS. A limit of detection is given. |
| | Metric 3: | Biomarker Selection | N/A | No biomarker is used in this study. |
| Domain 2: Representative | | | | |
| | Metric 4: | Testing Scenario | Low | Minimal data is provided regarding testing conditions. |
| | Metric 5: | Sample Size and Variability | Medium | 72 items were tested for phthalates, in categories of 9-20 items each. No indication whether replicates were used. |
| | Metric 6: | Temporality | High | Based on publication date, this is a recent study (less than 5 years old). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 7: | Reporting of Results | Low | Only a few summary statistics are reported for phthalates. |
| | Metric 8: | Quality Assurance | Low | There is no specific discussion of QA/QC procedures. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 9: | Variability and Uncertainty | Low | There is no specific discussion of variability or uncertainty. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Tang, Z., Chai, M., Cheng, J., Wang, Y., Huang, Q. (2019). Occurrence and distribution of phthalates in sanitary napkins from six countries: Implications for women's health. Environmental Science & Technology 53(23):13919-13928. |
| **HERO ID:** | 6816332 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology and Conditions | High | The sample collection mimics consumer behavior (on-line and store purchases). The study design called for a selection of ten whole samples and the creation of two composite samples for analysis made from subsets cut from the whole samples. The authors recognized the potential for contamination and sealed the composite samples quickly. |
| | Metric 2: | Analytical Methodology | Medium | The authors describe the instrument used and the sample preparation briefly in Section S1 of the Supplementary file. I do not see that they describe how they created the analysis sample (0.5g aliquot) from a large composite sample of pieces of ten whole sanitary napkins. I presume that the authors chose not to describe this detail, but it leaves out an important step if one wanted to repeat the experiment. The authors present a range of LOQs for phthalates in Section S1; from this, I could deduce that the LOQ for each chemical is presented as the "<#" in Table 1 of the main report that presents the results. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representative | | | | |
| | Metric 4: | Testing Scenario | High | The sample collection mimics consumer behavior (on-line and store purchases). The study did not include actual testing but is considered an Experimental type due to the samples being commercial products (i.e., not biological samples). |
| | Metric 5: | Sample Size and Variability | High | Each composite sample was composed of subsets derived from ten different sanitary napkins. The authors analyzed both composites and summarized by country of origin (n = 12 composites). |
| | Metric 6: | Temporality | High | The authors collected the samples in 2016, which is within five years of the current year (2021). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 7: | Reporting of Results | Medium | The authors did not include raw data in the material. They adjusted the concentrations for the amounts found in blanks, but they did not adjust the results for the recoveries. The information in Table 1 includes sample size, median, range, and detection frequency. |
| | Metric 8: | Quality Assurance | Medium | The authors recognized the potential for contamination and sealed the composite samples quickly. The study included blanks at intervals and tested for recoveries. Although the authors did not correct the concentrations for the recoveries, the rates for recoveries were high; from this, I assessed that the reported values would be suitable for extraction (with this caveat included in the notes). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 9: | Variability and Uncertainty | Medium | The authors described how different manufacturing methods (sometimes in different countries) could affect the concentrations of the phthalates in the products. The authors briefly mention that these chemicals have been found in other products in other studies, but they did not clarify how the results compare to studies of sanitary napkins except for their own previous work. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Lin, W. T., Chen, C. Y., Lee, C. C., Chen, C. C., Lo, S. C. (2021). Air phthalate emitted from flooring building material by the micro-chamber method: Two-stage emission evaluation and comparison. Toxics 9(9):216-216. |
| **HERO ID:** | 9384670 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology and Conditions | High | Six different flooring materials were tested, representing green building material and non-green building material labels in Taiwan. All pertinent details (e.g. temperature and humidity) of the micro-chamber method according to ISO 16000-25 were provided. |
| | Metric 2: | Analytical Methodology | Medium | GC/MS analysis method was used according to ISO 16000-33. The detection limit was 100 ppb and calibration curve was established. LC/MSMS analysis method was also used, and the detection limit was 2 ppb. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference |
| Domain 2: Representative | | | | |
| | Metric 4: | Testing Scenario | High | Testing was done in two stages representing normal temperatures and high temperatures. Blank experiment was done before the floor material tests. |
| | Metric 5: | Sample Size and Variability | Low | Six different flooring materials were tested. Replicate tests were not performed. |
| | Metric 6: | Temporality | High | The publication date is 2021. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 7: | Reporting of Results | Medium | One result per building material/stage of the experiment is reported in Table 5. Table 6 shows box plot summarizing all building materials. |
| | Metric 8: | Quality Assurance | Low | QA measures were described such as establishment of calibration curve and blank experiment. The recoveries were not reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 9: | Variability and Uncertainty | Low | The study captures variability in different types of green and non-green labeled flooring materials. However, uncertainties or limitations were not adequately discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Danish EPA, (2020). Survey of unwanted additives in PVC products imported over the internet. |
| **HERO ID:** | 11374030 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Sampling Methodology and Conditions | High | Products were selected according to various priority criteria including those that are commonly made from PVC (hard and soft) and are available to purchase by Danish consumers from frequently used foreign websites. Products also were required to contain chlorine. |
| | Metric 2: | Analytical Methodology | Medium | Danish Technological Institute's accredited Method OA-500 was used for phthalates, as detailed provided in Appendix 4. The method is GC-MS and is based on DS/ISO 16181. The detection limit is provided. Expanded analytic uncertainty (k=2): 35% RSD. Recovery values were not provided. |
| | Metric 3: | Biomarker Selection | N/A | Biomarkers of interest were not addressed in this reference. |
| Domain 2: Representative | | | | |
| | Metric 4: | Testing Scenario | Medium | Data represent consumer exposure scenario for multiple age groups. Products analyzed include children toys, pet toys, personal belongings (bags), hobby materials (tape, cutting board), mats, fitness equipment, footware, and rainwear. While products were purchased in the EU, they were all purchased on-line and all produced in China or other foreign countries. Pictures of products are provided. |
| | Metric 5: | Sample Size and Variability | High | Concentrations/weight fraction measurement for 41 soft PVC consumer product samples. Duplicate determination of the sample has been performed. |
| | Metric 6: | Temporality | High | Specific purchase data was not provided, but project was from May until December 2019. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 7: | Reporting of Results | Medium | Individual results reported for each sample/product, but raw data was not provided, and results were not summarized across product categories. |
| | Metric 8: | Quality Assurance | Low | Full evaluation of QA/QC was not provided. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 9: | Variability and Uncertainty | Low | Analytic uncertainty discussed. Full evaluation of variability and uncertainty was not provided. |

## Overall Quality Determination — Medium

| | |
|---|---|
| **Study Citation:** | Goldberg-Zoino & Assoc Inc, (1989). Monsanto 409 building phase II - site risk characterization Everett, Massachusetts volume III with attached tables, appendices and cover letter dated 072889. |
| **HERO ID:** | 1269798 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Methodology | High | High: Sampling and analytic methodologies, modeling equations reported in detail. |
| Domain 2: Representative | | | | |
| | Metric 2: | Exposure Scenario | Medium | Medium: Characterization of geographic area with map provided of site exposure sources, media of interest described, sample sizes not noted, temporal variability limited. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 3: | Documentation of References | Medium | Medium: References are available and provided, however some references may not be publicly available or are not from peer reviewed sources. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 4: | Variability and Uncertainty | Low | Low: Statistical summary measures of variability for concentration data lacking for most concentration data reported (some data reports concentration range), robust discussion of limitations lacking. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Geraghty & Miller Inc, (1994). Risk assessment for the BFGoodrich chemical division facility, Henry, Illinois with cover letter dated 05/06/94. |
| **HERO ID:** | 1333011 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | Metric 1: | Methodology | Low | Other than years and media of sample collection, sampling and analytic methodology not described. However, there is a detailed discussion of sampling assumptions provided. |
| Domain 2: Representative | Metric 2: | Exposure Scenario | Medium | The exposure activity assessed likely represents the population/scenario/media of interest. Characterization of geographic area with maps provided of site exposure sources, however characterization of population at risk lacking. |
| Domain 3: Accessibility/Clarity | Metric 3: | Documentation of References | Medium | References are available and provided, however some references may not be publicly available or are not from peer reviewed sources. |
| Domain 4: Variability and Uncertainty | Metric 4: | Variability and Uncertainty | Medium | Statistical summary measures of variability for concentration data for some, but not all reported concentrations in tables. Discussion of uncertainties detailed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Radian Corp, (1995). Initial submission: Baseline risk assessment for the Jayhawk site Galena, Kansas with attachments and cover letter dated 030195. |
| **HERO ID:** | 1482017 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Methodology | High | The methodology is well described across the document, equations reported inside tables |
| Domain 2: Representative | | | | |
| | Metric 2: | Exposure Scenario | High | Exposure to contaminants from the Jayhawk chemical site |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 3: | Documentation of References | High | Reported data well documented |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 4: | Variability and Uncertainty | Medium | Section 2.4.5 reports uncertainty. No statistics of variability reported |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Rohm and Haas, (1988). Biological risk assessment for the Redwood City facility {\&} final site investigation report for the Rohm and Haas Redwood City facility with attachments {\&} cover letter dated 092588 (Part a). |
| **HERO ID:** | 1745617 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Methodology | High | The methodology for the risk assessment is well described. Soil and groundwater monitoring methods in sections 2.1 and 2.2. Air quality methodology in section 6 |
| Domain 2: Representative | | | | |
| | Metric 2: | Exposure Scenario | High | Fish and wildlife exposure to selected contaminants in the groundwater beneath the Rohm and Hass facility in Redwood City |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 3: | Documentation of References | High | Data inputs, references all reported in the study |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 4: | Variability and Uncertainty | Medium | Variability across matrices not reported in terms of summary of statistics . Limitations reported in the text |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Wang, W., Wu, F. Y., Huang, M. J., Kang, Y., Cheung, K. C., Wong, M. H. (2013). Size fraction effect on phthalate esters accumulation, bioaccessibility and in vitro cytotoxicity of indoor/outdoor dust, and risk assessment of human exposure. Journal of Hazardous Materials 261:753-762. |
| **HERO ID:** | 2000934 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Methodology | High | Limited description of the assessment methodology in the main manuscript. Details about the risk assessment are available in the supplementary material. |
| Domain 2: Representative | | | | |
| | Metric 2: | Exposure Scenario | High | Data closely represent relevant exposure scenarios. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 3: | Documentation of References | High | References are available for all reported data. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 4: | Variability and Uncertainty | Medium | Variability was characterized, uncertainties and limitations were not discussed. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Chang, J. W., Yan, B. R., Chang, M. H., Tseng, S. H., Kao, Y. M., Chen, J. C., Lee, C. C. (2014). Cumulative risk assessment for plasticizer-contaminated food using the hazard index approach. Environmental Pollution 189:77-84. |
| **HERO ID:** | 2345995 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Methodology | High | The study describes sampling, analysis and models in detail. |
| Domain 2: Representative | | | | |
| | Metric 2: | Exposure Scenario | High | Exposure to phthalates in food. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 3: | Documentation of References | High | Data reported in both main text and supplementary information. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 4: | Variability and Uncertainty | Medium | Variability is reported across the data, no limitations reported. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | CHAP, (2014). Chronic Hazard Advisory Panel on phthalates and phthalate alternatives (with appendices). |
| **HERO ID:** | 2439960 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Methodology | High | Report by the Chronic Hazard Advisory Panel on Phthalates and Phthalate Alternative. Systematic review process reported in page 11. |
| Domain 2: Representative | | | | |
| | Metric 2: | Exposure Scenario | High | Worldwide HBM data from 1988 to 2007 reported. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 3: | Documentation of References | High | References available. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 4: | Variability and Uncertainty | High | Variability and uncertainty reported in section 4.1. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Li, R., Liang, J., Gong, Z., Zhang, N., Duan, H. (2017). Occurrence, spatial distribution, historical trend and ecological risk of phthalate esters in the Jiulong River, Southeast China. Science of the Total Environment 580(Elsevier):388-397. |
| **HERO ID:** | 3483279 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Methodology | High | Scientifically sound methodology. |
| Domain 2: Representative | | | | |
| | Metric 2: | Exposure Scenario | High | Data closely represent exposure scenarios of interest. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 3: | Documentation of References | High | References are available for all reported data. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 4: | Variability and Uncertainty | Medium | Characterized variability, limited description of uncertainties. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Giovanoulis, G., Bui, T., Xu, F., Papadopoulou, E., Padilla-Sanchez, J. A., Covaci, A., Haug, L. S., Cousins, A. P., Magnér, J., Cousins, I. T., de Wit, C. A. (2017). Multi-pathway human exposure assessment of phthalate esters and DINCH. Environment International 112:115-126. |
| **HERO ID:** | 4166920 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | Metric 1: | Methodology | High | Monitoring methodology, equipment and storage are reported. Analytical methods and instrument reported. Modeling equations and inputs are reported with references. |
| Domain 2: Representative | Metric 2: | Exposure Scenario | Medium | The study measured daily intake through inhalation, dermal and oral of phthalates. However, sampling was done 2013-104 in Norwegian and may not represent scenarios in the US. |
| Domain 3: Accessibility/Clarity | Metric 3: | Documentation of References | High | References are available for all reported data, inputs, and defaults. |
| Domain 4: Variability and Uncertainty | Metric 4: | Variability and Uncertainty | High | Characterized variability through different media tested. The study discussed uncertainties and limitations. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | U.S. Consumer Product Safety Commission (CPSC) (2015). Estimated phthalate exposure and risk to pregnant women and women of reproductive age as assessed using four NHANES biomonitoring data sets (2005/2006, 2007/2008, 2009/2010, 2011/2012). |
| **HERO ID:** | 5155509 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Methodology | High | The study reports the considerations used for daily intakes, hazard quotients and the use of the biomonitoring data. |
| Domain 2: Representative | | | | |
| | Metric 2: | Exposure Scenario | High | Phthalate exposure and risk to pregnant women and women of reproductive age. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 3: | Documentation of References | High | The study reports the references from NHANES data. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 4: | Variability and Uncertainty | Medium | The study reports variability across different populations. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | EC/HC, (2017). Draft screening assessment: Phthalate substance grouping. |
| **HERO ID:** | 5353181 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Methodology | Medium | Most of the techniques and assumptions cited references, with models providing equations and inputs. |
| Domain 2: Representative | | | | |
| | Metric 2: | Exposure Scenario | High | The data closely represent relevant exposure scenarios related to phthalates in water bodies from Canada, consumer products, and biomonitoring daily intakes. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 3: | Documentation of References | Medium | References are available for most reported data, inputs, and defaults; however, some references may not be publicly available or are not from peer reviewed sources. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 4: | Variability and Uncertainty | High | Variability (arithmetic mean, percentiles) and uncertainty were characterized in detail throughout the report. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Anderson, D., Dicianna, D., Yance, J., Tarnay, A. (1989). Preliminary data summary for the solvent recycling industry. |
| **HERO ID:** | 5478191 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Methodology | Medium | Sampling are referenced in other sources for each plant in section 5.3.1. Analytical methods and instrument are reported, including detection limit range. Simple standard dilution model used to calculate effluent concentrations in Section 6, although effluent concentrations don't appear to reported. |
| Domain 2: Representative | | | | |
| | Metric 2: | Exposure Scenario | Medium | The study measured chemicals in wastewater. However, the study and sampling dates are old (1986 and 1987). |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 3: | Documentation of References | Low | Document is well referenced, but many references don't appear to be published. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 4: | Variability and Uncertainty | Medium | Data specifically examined for three facilities. Some discussions of analytical uncertainties provided. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Christia, C., Poma, G., Harrad, S., De Wit, C. A., Sjostrom, Y., Leonards, P., Lamoree, M., Covaci, A. (2019). Occurrence of legacy and alternative plasticizers in indoor dust from various EU countries and implications for human exposure via dust ingestion and dermal absorption. Environmental Research 171:204-212. |
| **HERO ID:** | 5772597 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | Metric 1: | Methodology | High | Monitoring methods, equipment and storage were reported. Analytical methods and instrument reported. Modeling equations and inputs provided with references. |
| Domain 2: Representative | Metric 2: | Exposure Scenario | Medium | The study analyzed exposure to indoor dust, with samples taken from 2016-2017. However, the study was conducted in Europe and may not be representative of the US. |
| Domain 3: Accessibility/Clarity | Metric 3: | Documentation of References | High | References are available for all reported data, inputs, and defaults. |
| Domain 4: Variability and Uncertainty | Metric 4: | Variability and Uncertainty | Medium | The study characterized variability with different seasons and microenvironments measured. There is no description of uncertainty. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Danish EPA, (2009). Survey and health assessment of the exposure of 2 year-olds to chemical substances in consumer products. |
| **HERO ID:** | 6302975 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | Metric 1: | Methodology | High | The study reports the methodology for selecting the consumer products, laboratory methods for chemical analysis, migration analysis, and calculation of exposure. |
| Domain 2: Representative | Metric 2: | Exposure Scenario | High | This study is a health assessment to evaluate the exposure of 2-year-olds to selective chemicals in consumer products including toys and clothing. |
| Domain 3: Accessibility/Clarity | Metric 3: | Documentation of References | High | The references are available for all the reported data. |
| Domain 4: Variability and Uncertainty | Metric 4: | Variability and Uncertainty | High | The study characterizes the variability of chemicals and exposure in a range of consumer products. The limitations of the study are reported in the conclusion section page 260. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Danish EPA, (2011). Annex XV restriction report: Proposal for a restriction, version 2. Substance name: bis(2-ehtylhexyl)phthlate (DEHP), benzyl butyl phthalate (BBP), dibutyl phthalate (DBP), diisobutyl phthalate (DIBP). |
| **HERO ID:** | 7265437 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | Metric 1: | Methodology | High | The assessment uses technical approaches generally accepted by the scientific community and provides detailed methods of sampling, with assumptions, uncertainties in sampling presented. |
| Domain 2: Representative | Metric 2: | Exposure Scenario | Medium | Exposure activity assessed likely represents the scenario of interest with consumer product exposures and estimated daily dose from exposure environments (indoor air, household dust, food and biomonitoring results from previous studies) described. |
| Domain 3: Accessibility/Clarity | Metric 3: | Documentation of References | Medium | References are available and provided, however some references may not be publicly available or are not from peer reviewed sources. |
| Domain 4: Variability and Uncertainty | Metric 4: | Variability and Uncertainty | Medium | Study characterization of variability presented within most results; discussion of key assumptions and study limitations extensive. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | ECHA, (2012). Committee for Risk Assessment (RAC) Committee for Socio-economic Analysis (SEAC): Background document to the Opinion on the Annex XV dossier proposing restrictions on four phthalates: Annexes. |
| **HERO ID:** | 7325405 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | Metric 1: | Methodology | Medium | The assessment uses technical approaches generally accepted by the scientific community and lacks a literature flow diagram but provides details on databases and search terms utilized. |
| Domain 2: Representative | Metric 2: | Exposure Scenario | Medium | Exposure activity assessed likely represents the scenario of interest, some key details on geographic location of sampling lacking but consumer product exposures and estimated daily dose from exposure environments from previous studies described. |
| Domain 3: Accessibility/Clarity | Metric 3: | Documentation of References | Medium | References are available and provided, however some references may not be publicly available or are not from peer reviewed sources. |
| Domain 4: Variability and Uncertainty | Metric 4: | Variability and Uncertainty | Medium | Study characterization of variability presented within some results; discussion of key assumptions and study limitations and assumptions in exposure modeling presented within text and tables. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Danish EPA, (2012). Survey No. 117: Exposure of pregnant consumers to suspected endocrine disruptors. |
| **HERO ID:** | 10622425 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | Metric 1: | Methodology | High | The assessment reports the methodology to assess concentrations in selected consumer products and the methods to evaluate the exposure. |
| Domain 2: Representative | Metric 2: | Exposure Scenario | High | This health assessment evaluates the exposure of pregnant women to a selected chemicals by the use of consumer products. |
| Domain 3: Accessibility/Clarity | Metric 3: | Documentation of References | High | References are available for all reported data, inputs, and defaults. |
| Domain 4: Variability and Uncertainty | Metric 4: | Variability and Uncertainty | Medium | Variability of concentrations is reported for selected consumer products, but the results do not report statistical variability. Some limitations are reported in the conclusion section. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Koo, J. W., Parham, F., Kohn, M. C., Masten, S. A., Brock, J. W., Needham, L. L., Portier, C. J. (2002). The association between biomarker-based exposure estimates for phthalates and demographic factors in a human reference population. Environmental Health Perspectives 110(4):405-410. |
| **HERO ID:** | 673288 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | Equations for estimating intakes and intermediate values required are all provided, described, and cited (Kohn et al). |
| | Metric 2: | Model Evaluation | High | Regression analysis conducted in LIFEREG, SAS 8.0, widely accepted. The model is from peer reviewed study and has undergone evaluation. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Concentration data used in model from 2000 and limited discussion of exposure factors. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | Low | SAS 8.0 is not freely and publicly available. Some references might not be publicly available. |
| | Metric 5: | Model Inputs and Defaults | High | Fractional excretions are provided with descriptions, all inputs are provided. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | Low standard error in regression estimates and significant demographic variations in exposure and metabolism of phthalates; some discussion on uncertainty related to sufficient data, range of data sources, issues and assumptions relating to estimates from metabolites. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | David, R. M. (2000). Exposure to phthalate esters. Environmental Health Perspectives 108(10):A440. |
| **HERO ID:** | 675063 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | Medium | Equation for estimating daily intake from measured urinary concentrations provided, with citation to source that is not publicly available to review methodology. |
| | Metric 2: | Model Evaluation | Medium | Limited discussion on methodology for converting concentrations to intakes. Some reference to other agencies/studies doing similar work. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Response to a 2000 study (Blount et al) using NHANES data for urinary levels of phthalate ester metabolites. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | Low | Equation is provided but methodology/source cannot be publicly accessed. |
| | Metric 5: | Model Inputs and Defaults | Medium | Inputs are described but values not provided; may be available in the Blount et al. paper referenced. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Low | Limited discussion of uncertainties and variability; 95th percentile and highest values provided for comparison. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Kohn, M. C., Parham, F., Masten, S. A., Portier, C. J., Shelby, M. D. (2000). Human exposure estimates for phthalates. Environmental Health Perspectives 108(10):A440-A442. |
| **HERO ID:** | 675254 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | Daily exposure is estimated using a linear 2-compartment model, with equations 1 & 2 provided for total and urinary excretion fractions (and rate constants), and equation 3 for individual intake. |
| | Metric 2: | Model Evaluation | Medium | Model has at least limited evaluation through comparison with data from other models. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Low | Article is from 2000; >15 years and may not represent current exposures. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | There is some documentation available in the data source; this article is cited in other studies. |
| | Metric 5: | Model Inputs and Defaults | Medium | Inputs and defaults are generally identified, referenced and described. Metabolite concentrations may be found in Blount et al 2000. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | Measures of uncertainty are discussed on pp. A441 and A442. Limitations not discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Tan, B. L., Hawker, D. W., Muller, J. F., Leusch, F. D., Tremblay, L. A., Chapman, H. F. (2007). Modelling of the fate of selected endocrine disruptors in a municipal wastewater treatment plant in South East Queensland, Australia. Chemosphere 69(4):644-654. |
| **HERO ID:** | 675442 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | Medium | Most equations were referenced from peer reviewed sources. Mass balance approach was explained and a scientifically sound approach. |
| | Metric 2: | Model Evaluation | Medium | Many studies were referenced supporting the current approach. Evaluation was conducted by author of study (reported good correlation between measured and estimated effluent concentrations) |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Low | Exposure scenario of > 15 years ago |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | Low | Many different peer reviewed papers were referenced; not all of free to the public |
| | Metric 5: | Model Inputs and Defaults | High | All inputs were defined, values provided, and referenced when applicable. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | some discussion included on variability and uncertainty. |

## Overall Quality Determination Medium

**Study Citation:** Fromme, H., Gruber, L., Schlummer, M., Wolz, G., Bohmer, S., Angerer, J., Mayer, R., Liebl, B., Bolte, G. (2007). Intake of phthalates and di(2-ethylhexyl)adipate: Results of the Integrated Exposure Assessment Survey based on duplicate diet samples and biomonitoring data. Environment International 33(8):1012-1020.

**HERO ID:** 680285

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | Intake modeling equation is given and appears to be based on previously published and peer-reviewed material. |
| | Metric 2: | Model Evaluation | Medium | The intake equation used for modeling is cited as being based on two previous papers. There is no specific evaluation of its appropriateness for this group of chemicals. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Low | Data was collected at some point between late 2005 and 2007, so it may not reflect current exposure conditions. The population of the study was German, so results may not correspond to US populations. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | The model intake equation input variables are given in the paper. |
| | Metric 5: | Model Inputs and Defaults | High | The input values that were used are provided in the paper, and are cited to previous peer-reviewed works. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | There is discussion of variability within the subjects, and there is a discussion of the limitations of the approach used for calculation. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Kondo, F., Ikai, Y., Hayashi, R., Okumura, M., Takatori, S., Nakazawa, H., Izumi, S., Makino, T. (2010). Determination of five phthalate monoesters in human urine using gas chromatography-mass spectrometry. Bulletin of Environmental Contamination and Toxicology 85(1):92-96. |
| **HERO ID:** | 697322 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | This study uses a standard equation for estimating phthalate intake from urinary metabolites (Kohn et al. 2000; Koch et al.2003; Itoh et al. 2005). |
| | Metric 2: | Model Evaluation | High | The equation used in this paper is frequently used in the literature for this purpose and is peer reviewed. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Low | The biomonitoring scenario is relevant, but the data is more than five years old, and was collected in Japan rather than the US. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | The intake equation and the necessary input variables are given in this paper and referenced. |
| | Metric 5: | Model Inputs and Defaults | High | The values used are inputs are provided, and are cited to previous peer-reviewed works. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | There is some discussion of variability and uncertainty in the paper's approach and its results. Limitations are not described. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Lin, S., Ku, H., Su, P., Chen, J., Huang, P., Angerer, J., Wang, S. (2011). Phthalate exposure in pregnant women and their children in central Taiwan. Chemosphere 82(7):947-955. |
| **HERO ID:** | 699479 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | Estimated daily intake equation provided with an example calculation; intermediate equation also provided for parent compounds from metabolite concentrations |
| | Metric 2: | Model Evaluation | Low | No evaluation indicated in the study, but assumption of some degree due to peer review publication. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | 2011 study with data going back to 2001 limits temporal relevance and data are specific to Taiwanese population, which may limit spatial relevance to US as well. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | Equations and inputs can be followed. Additional documentation not needed. |
| | Metric 5: | Model Inputs and Defaults | High | All inputs are provided with references where needed or calculations where appropriate. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | Some variability in the population and media (exposure via urine, milk, blood vs plastics) discussed. Some discussion of uncertainties around additive effects and secretion fractions. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Frederiksen, H., Aksglaede, L., Sorensen, K., Skakkebaek, N. E., Juul, A., Andersson, A. M. (2011). Urinary excretion of phthalate metabolites in 129 healthy Danish children and adolescents: Estimation of daily phthalate intake. Environmental Research 111(5):656-663. |
| **HERO ID:** | 787933 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | The estimated daily intake equation is provided in Section 2.4. |
| | Metric 2: | Model Evaluation | High | The equation used here is of a type frequently used in the literature for this purpose, and is cited to a previous peer-reviewed study. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Low | The data used in this study is between 5 and 15 years old, and is taken from Danish sources. The scenario is of interest, but the results may not be entirely applicable to the current US population. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | The equation used for modeling intakes is provided in this paper, and the required input variables are described. Equation is from peer reviewed source and has been reviewed. |
| | Metric 5: | Model Inputs and Defaults | High | The inputs are either based on the monitoring results, or are cited from previous peer-reviewed sources. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | High | There is some discussion of how variability in storage conditions may have affected the monitoring samples, which were used in calculating the daily intake values. Limitations are described for the estimated DI. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Weschler, C. J., Nazaroff, W. W. (2012). SVOC exposure indoors: Fresh look at dermal pathways. Indoor Air 22(5):356-377. |
| **HERO ID:** | 1315313 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | All equations are provided in detail with cited references, assuming some validity based on previous peer review |
| | Metric 2: | Model Evaluation | Medium | Model equations discussed across studies and some estimates compared to other studies |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | High | Dermal exposure to chemicals is a relevant scenario and can be applied to a variety of products; Data used in the models is from USEPA study of Children's Total Exposure to Persistent Pesticides and Other Persistent Organic Pollutants (CTEPP) |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | Model can be followed through in order of presentation with use of references, no user guide needed |
| | Metric 5: | Model Inputs and Defaults | High | All inputs are provided with citations for values or equations |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | High | Discussion of chemical specific properties and other pathways not covered by the presented models as limitations; uncertainties discussed around assumption of equilibrium |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Frederiksen, H., Nielsen, J. K., Mørck, T. A., Hansen, P. W., Jensen, J. F., Nielsen, O., Andersson, A. M., Knudsen, L. E. (2013). Urinary excretion of phthalate metabolites, phenols and parabens in rural and urban Danish mother-child pairs. International Journal of Hygiene and Environmental Health 216(6):772-783. |
| **HERO ID:** | 1588874 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | Medium | Equations are referenced and from peer reviewed sources. |
| | Metric 2: | Model Evaluation | Low | Equations are from and in peer reviewed sources; no more formal evaluation mentioned. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Exposure from 2011; between 5 - 15 years ago. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | Low | Some of the referenced sources for the equations are not free to the public. |
| | Metric 5: | Model Inputs and Defaults | High | Model inputs are defined, values are provided and referenced when applicable. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | Discussion included on variability and uncertainty; the use of metabolites for parent compounds was addressed. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Zeman, F. A., Boudet, C., Tack, K., Floch Barneaud, A., Brochot, C., Péry, A. R., Oleko, A., Vandentorren, S. (2013). Exposure assessment of phthalates in French pregnant women: Results of the ELFE pilot study. International Journal of Hygiene and Environmental Health 216(3):271-279. |
| **HERO ID:** | 1588878 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | Equation provided and well-described for daily intake calculated from urinary phthalate metabolites (from Kohn et al., 2000). Scenario-based exposure media model (Wormuth et al., 2006) was also used for comparison but was not as well described. |
| | Metric 2: | Model Evaluation | Medium | Some evaluation and comparison with other models; foreign study. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Samples collected fall 2007, French study. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | Low | Limited documentation was provided; additional documentation might be found in cited references. |
| | Metric 5: | Model Inputs and Defaults | Medium | Inputs are generally identified, especially for calculation of daily intake from metabolites. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | Large sample size but study was considered a pilot and some uncertainties were identified. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Shen, L., Xia, B., Dai, X. (2013). Residues of persistent organic pollutants in frequently-consumed vegetables and assessment of human health risk based on consumption of vegetables in Huizhou, South China. Chemosphere 93(10):2254-2263. |
| **HERO ID:** | 2149595 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | Weight-specific daily intake equations are provided in section 2.6. |
| | Metric 2: | Model Evaluation | High | The intake equations appear to be of the standard type, and the results are evaluated by comparing them against similar studies from around the world. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | This study is more than five years old and based on data collected in China, so it may not accurately reflect the US population. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | The intake equations are provided and the required input variables are described. |
| | Metric 5: | Model Inputs and Defaults | Medium | Model inputs appear to be based partly on monitoring data and survey results, and partly on previous published values which are cited. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | There was some discussion of what might account for variation found between different categories of vegetables. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Fromme, H., Lahrz, T., Kraft, M., Fembacher, L., Dietrich, S., Sievering, S., Burghardt, R., Schuster, R., Bolte, G., Völkel, W. (2013). Phthalates in German daycare centers: Occurrence in air and dust and the excretion of their metabolites by children (LUPE 3). Environment International 61:64-72. |
| **HERO ID:** | 2215411 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | The equation for total daily intake of phthalates as estimated using urinary metabolite concentrations was provided and referenced (David 2000) in Section 2.6, p. 66. |
| | Metric 2: | Model Evaluation | Medium | Accepted model (David 2000) has been cited in other references. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Study was conducted 2011-2012 at German daycare centers. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | Low | Possible incorrect reference citation. Refer to HERO #675063, which includes David 2000 and Kohn et al. 2000; Equation in study under review looks like equation from Kohn et al. |
| | Metric 5: | Model Inputs and Defaults | High | Model inputs and defaults, with references, are provided in section 2.6, p. 66. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | Large study of young children in German daycare centers. Uncertainty is discussed regarding inappropriateness of creatinine-adjustment of samples from children, and also in terms of sample timing relative to half-life of analyses. |

## Overall Quality Determination Medium

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|---|---|
| **Study Citation:** | Shin, H. M., Mckone, T. E., Nishioka, M. G., Fallin, M. D., Croen, L. A., Hertz-Picciotto, I., Newschaffer, C. J., Bennett, D. H. (2014). Determining source strength of semivolatile organic compounds using measured concentrations in indoor dust. Indoor Air 24(3):260-271. |
| **HERO ID:** | 2215665 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | Most equations provided in text, with additional equations and figures provided in the supplemental file with citations; equations for surface area emission rates, gas/dust concentrations, and saturation concentrations. |
| | Metric 2: | Model Evaluation | Medium | All equations have peer reviewed citations, estimated emission rates only compared to reported values in two studies for DEHP. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Estimates and models relevant for plastics and building materials but not personal care products. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | Equations are all provided and supplemental documentation is available. |
| | Metric 5: | Model Inputs and Defaults | Medium | Inputs listed in supplemental table 2 and throughout paper after their relevant equations; most of the inputs are secondary or estimated. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | High | Uncertainty analysis conducted for the input variables. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Qian, H., Chen, M., Kransler, K. M., Zaleski, R. T. (2015). Assessment of chemical coexposure patterns based upon phthalate biomonitoring data within the 2007/2008 National Health and Nutrition Examination Survey. Journal of Exposure Science & Environmental Epidemiology 25(3):249-255. |
| **HERO ID:** | 2345931 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | Medium | Equation for daily intakes provided and briefly described, estimating from urinary metabolite concentrations. Equation is cited to David 2000 and Kohn et al 2000 but authors do not specify the specific contributions of each source. The equation for exposure to multiple metabolites is not cited but appears scientifically sound and consistent with single metabolite estimates. |
| | Metric 2: | Model Evaluation | Low | Peer review needed for publication, but no specific validation of model or outputs by the authors. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Daily intakes are based on NHANES 2007-2008 data. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | Low | Intake equations and inputs are mostly sufficient but the concentrations used from NHANES are not reported in this study for reference. |
| | Metric 5: | Model Inputs and Defaults | Medium | Fractional urinary excretion rates of the metabolites are tabulated with citations, but other sample data not provided (concentrations, body weights). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | Daily intakes estimated for 5, 10, 25, 50, 75, 90, and 95 percentiles. Limited discussion on uncertainties related to singular exposures, but some discussion presented on coexposure patterns. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Frederiksen, H., Kuiri-Hänninen, T., Main, K. M., Dunkel, L., Sankilampi, U. (2014). A longitudinal study of urinary phthalate excretion in 58 full-term and 67 preterm infants from birth through 14 months. Environmental Health Perspectives 122(9):998-1005. |
| **HERO ID:** | 2347101 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | Medium | Daily intake equation is provided, briefly described, and appears scientifically sound. Not clear if the entire equation or just the CEsmoothed parameter is cited to Al-Dahhan et al 1988. |
| | Metric 2: | Model Evaluation | Medium | Proposed model is evaluated for relevance to the scenario and modified accordingly for different phthalates based on previous research, but no other indication of evaluation outside of peer review for publication. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Mothers included in the Finnish Minipuberty study were recruited between 2006 and 2008. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | The model and documentation (user guide, documentation manual) are publicly available or there is sufficient documentation in the data source or in a companion reference. |
| | Metric 5: | Model Inputs and Defaults | Medium | Most inputs are identified, described, and provided with particular detail given to the excretion fractions for each metabolite, including references; BW and CE not tabulated. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | Median, 70 and 90 percentiles, and maximum daily intakes provided for full term and preterm infant exposures; intakes are presented for each phthalate at four ages (7 days, 2 months, 6 months, 14 months). Uncertainty discussed primarily as it relates to hazard index rather than daily intake, though related. Some uncertainty discussed related to other sources of exposure based on correlations identified between terms. Limitations not described. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Sakhi, A. K., Lillegaard, I. T., Voorspoels, S., Carlsen, M. H., Løken, E. B., Brantsæter, A. L., Haugen, M., Meltzer, H. M., Thomsen, C. (2014). Concentrations of phthalates and bisphenol A in Norwegian foods and beverages and estimated dietary exposure in adults. Environment International 73:259-269. |
| **HERO ID:** | 2501495 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | Low | General modeling approach is given and seems to be standard, but no specific equation is provided. |
| | Metric 2: | Model Evaluation | Low | General modeling approach is given and seems to be standard, but no specific equation is provided. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Low | This is a moderately recent study (5-15 years old) but the study population is Norwegian, so there may be dietary differences from the US population. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | Low | The model is only broadly described, and must be inferred to be typical of dietary intake modeling. |
| | Metric 5: | Model Inputs and Defaults | Low | Some relevant values such as body weight are taken from a previous survey and not reported in this paper. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | There is some discussion of variation from country to country in similar dietary studies. |

## Overall Quality Determination Low

| | |
|---|---|
| **Study Citation:** | Myridakis, A., Fthenou, E., Balaska, E., Vakinti, M., Kogevinas, M., Stephanou, E. G. (2015). Phthalate esters, parabens and bisphenol-A exposure among mothers and their children in Greece (Rhea cohort). Environment International 83:1-10. |
| **HERO ID:** | 2914665 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | Equation used to estimate daily intake from urinary metabolite concentration provided with citations and description of sound approach. |
| | Metric 2: | Model Evaluation | Low | Peer reviewed publication of equation, so some evaluation. Urinary concentrations were compared to other studies, which directly impacts estimated daily intakes but daily intake was not directly evaluated. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Intakes are representative of pregnant Greek women (Rhea project) from 2007-2008. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | Low | Equation and data are provided, but statistics were done in SPSS which is not free and publicly accessible. |
| | Metric 5: | Model Inputs and Defaults | High | Model inputs are identified, described, and values are cited when needed. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | Median, 95th percentile, maximum, and arithmetic and geometric means provided with 95% CI for both mothers and children; minimum only provided for DEP. Variability characterized for concentrations but not intakes. There is some discussion on exposure patterns in the data. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Enault, J., Robert, S., Schlosser, O., de Thé, C., Loret, J. F. (2015). Drinking water, diet, indoor air: Comparison of the contribution to environmental micropollutants exposure. International Journal of Hygiene and Environmental Health 218(8):723-730. |
| **HERO ID:** | 2919757 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | Low | Dietary exposure equation included and referenced from a peer-reviewed source. Exposure through air equations were also included but were not referenced. |
| | Metric 2: | Model Evaluation | High | Exposure equations are widely accepted among the scientific community. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Exposure scenario occurred 5-15 years ago. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | Low | All references for the equations are not available to the public for free. |
| | Metric 5: | Model Inputs and Defaults | High | Model inputs are described in the text following the equations and are provided with references. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Low | Text included briefly describing uncertainty, limitations, and data gaps in the discussion. Many of the measurements were unquantifiable and therefore the LOQ was used - high level of uncertainty. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Wei, W., Mandin, C., Blanchard, O., Mercier, F., Pelletier, M., Le Bot, B., Glorennec, P., Ramalho, O. (2017). Predicting the gas-phase concentration of semi-volatile organic compounds from airborne particles: Application to a French nationwide survey. Science of the Total Environment 576(Elsevier):319-325. |
| **HERO ID:** | 3454652 |

| Domain | Metric | | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | Medium | Equations are all referenced from peer reviewed sources; Monte Carlo approach was also described. |
| | Metric 2: | Model Evaluation | Medium | Validation of new methods used was conducted by the authors. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Low | Data used in study was from 2003-2005. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | All reference equations used are not free to the public (e.g., Wei et al 2016a). |
| | Metric 5: | Model Inputs and Defaults | High | Inputs are all described (some are in supplemental material). |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | High | Discussion included on uncertainty and variability. |

## Overall Quality Determination Medium

**Study Citation:** Muenhor, D., Moon, H. B., Lee, S., Goosey, E. (2018). Organophosphorus flame retardants (PFRs) and phthalates in floor and road dust from a manual e-waste dismantling facility and adjacent communities in Thailand. Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 53(1):79-90.

**HERO ID:** 4164912

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | Low | Exposure equation not provided but inputs and assumptions are described to follow procedures for standard dust ingestion exposure. |
| | Metric 2: | Model Evaluation | Low | Exposure estimates are compared to RfDs and the concentrations used in the estimates are compared against other studies. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Data on floor and road dust are from 2018 and represent exposures to e-waste. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | Low | Equation for exposure not provided. |
| | Metric 5: | Model Inputs and Defaults | Low | Various inputs are identified, described, and cited (body weight, exposure time, ingestion rate) but cannot validate that all inputs have been provided without the equation. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | Limited discussion on the uncertainties in the data or limitations of the study. |

## Overall Quality Determination Low

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|---|---|
| **Study Citation:** | Pelletier, M., Bonvallot, N., Ramalho, O., Mandin, C., Wei, W., Raffy, G., Mercier, F., Blanchard, O., Le Bot, B., Glorennec, P. (2017). Indoor residential exposure to semivolatile organic compounds in France. Environment International 109:81-88. |
| **HERO ID:** | 4165791 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | Medium | All equations are cited and from peer reviewed sources. |
| | Metric 2: | Model Evaluation | High | Methods and Crystal Ball software are well known and have undergone evaluation. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Exposure data from previously published studies; 5-15 years ago. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | Low | All referenced materials for the modeling methods are not free and available to the public. |
| | Metric 5: | Model Inputs and Defaults | High | All inputs are defined and values referenced (when applicable); Crystal Ball was used in a probabilistic risk assessment so exact values are not always available. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | High | Included relative contribution of key parameters. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Quintana-Belmares, R. O., Krais, A. M., Esfahani, B. K., Rosas-Pérez, I., Mucs, D., López-Marure, R., Bergman, Å., Alfaro-Moreno, E. (2018). Phthalate esters on urban airborne particles: Levels in PM10 and PM2.5 from Mexico City and theoretical assessment of lung exposure. Environmental Research 161:439-445. |
| **HERO ID:** | 4167514 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | Monthly calculations and lung exposure assessment equations reported. Modeling approach seems basically sound; all results can be viewed in the supplemental spreadsheet. |
| | Metric 2: | Model Evaluation | Medium | Lung exposure assessment equation comes from peer review. Monthly exposure to phthalates via particulate matter does not appear to be a scenario that has much previous study behind it. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | This is a recent study, though based on data collected in Mexico more than 5 years ago. However, it is uncertain whether the findings can be generalized, as the exposure is calculated month-to-month for the specific 7-month period of the samplings, and there is a high degree of temporal variability over that period. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | The study and supplemental spreadsheet file contains all the models and calculations. |
| | Metric 5: | Model Inputs and Defaults | High | Values used to calculate respiratory flow rates and hourly PM data are cited from previous peer-reviewed sources. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | There is discussion of variability in the monitoring data from which the exposures are calculated, including different months, gender and ages. There is no discussion of limitations. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Weiss, J. M., Gustafsson, Å., Gerde, P., Bergman, Å., Lindh, C. H., Krais, A. M. (2018). Daily intake of phthalates, MEHP, and DINCH by ingestion and inhalation. Chemosphere 208:40-49. |
| **HERO ID:** | 4728899 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | Inhalation and ingestion exposure equations are provided in the paper. |
| | Metric 2: | Model Evaluation | High | Ingestion intake equation is cited from a previous published paper; inhalation intake equation seems mathematically sound. MPPD model used for calculating inhalation parameters appears well-attested. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | This is a recent paper, though it is based on data from Sweden rather than the US. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | Inhalation and ingestion exposure equations are provided in the paper itself. The MPPD model used to calculate inhalation parameters appears to be freely available online. |
| | Metric 5: | Model Inputs and Defaults | High | Input values are cited throughout the paper, and come from the MPPD model or other reputable sources. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | There is some discussion of variance and the limitations of the study, though these seem to apply mainly to the monitoring portion. |

## Overall Quality Determination High

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|---|---|
| **Study Citation:** | Okeme, J. O., Nguyen, L. V., Lorenzo, M., Dhal, S., Pico, Y., Arrandale, V. H., Diamond, M. L. (2018). Polydimethylsiloxane (silicone rubber) brooch as a personal passive air sampler for semi-volatile organic compounds. Chemosphere 208:1002-1007. |
| **HERO ID:** | 5017615 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | Low | Simple calculation to determine inhalation exposure was described in data source but no equation was provided. |
| | Metric 2: | Model Evaluation | Medium | For evaluation, exposure results were compared with results from an 8-hr sample using a different collection method. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | High | Canadian study was published in 2018. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | Low | There is limited description of the simple inhalation exposure model but there may be additional information in the reference for inhalation rate (USEPA 2011, Exposure Factors Handbook). |
| | Metric 5: | Model Inputs and Defaults | Medium | Model inputs and defaults are generally identified, described and referenced. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | The study characterizes and discusses variability in the personal air concentration inputs and sampling rates used in the exposure calculation. Uncertainty and data limitations are also discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Chen, Y., Jiang, L., Lu, S., Kang, L., Luo, X., Liu, G., Cui, X., Yu, Y. (2019). Organophosphate ester and phthalate ester metabolites in urine from primiparas in Shenzhen, China: Implications for health risks. Environmental Pollution 247:944-952. |
| **HERO ID:** | 5039996 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | Estimated daily intake equation was referenced and based on a scientifically sound approach. |
| | Metric 2: | Model Evaluation | Medium | Intake equation was referenced from peer reviewed sources; no mention of a more formal review. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Sampling was conducted 2013 to 2015. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | Low | Equation references are not free to the public (e.g., Guo et al 2011a). |
| | Metric 5: | Model Inputs and Defaults | High | All model inputs are defined, values provided, and referenced when applicable. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | There was some discussion included on variability and uncertainty. Page 950 discusses uncertainty of using Fraction urinary excretion. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Velázquez-Gómez, M., Hurtado-Fernández, E., Lacorte, S. (2019). Differential occurrence, profiles and uptake of dust contaminants in the Barcelona urban area. Science of the Total Environment 648:1354-1370. |
| **HERO ID:** | 5043338 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | Total daily intake equation provided, explained, and cited. |
| | Metric 2: | Model Evaluation | Medium | Exposure levels compared to other published studies for similarity. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Dust exposure is a relevant scenario, but the concentrations used in the exposure calculations may not be transferrable to US as they are from Spanish monitoring studies. Additionally, the time of collection is not specified, but refers to a previous sampling study. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | Equations are given and references included. Exposure estimation methods based on Cristale et al 2018 and Gevao et al 2006. |
| | Metric 5: | Model Inputs and Defaults | High | Key inputs (dust ingestion rates) are from Ali et al 2012 and Jones-Otazo et al 2005 for mean and high exposure situations. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | Not much discussion included about uncertainty and variability. Median and high scenarios based on concentrations from multiple locations. Toddlers and teenagers considered separately from adults as "staff" at the key locations. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Al Qasmi, N. N., Al-Thaiban, H., Helaleh, M. I. H. (2019). Indoor phthalates from household dust in Qatar: Implications for non-dietary human exposure. Environmental Science and Pollution Research 26(1):421-430. |
| **HERO ID:** | 5043469 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | The intake equation for dust ingestion is provided and described in sufficient detail. |
| | Metric 2: | Model Evaluation | High | The intake modeling equation appears to be of a standard form, and the paper compares its results to similar studies from around the world. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | This is a recent study (<5 years old) but the data collected is from Qatar. As the authors note, climate factors mean that indoor exposure parameters may differ from elsewhere in the world. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | The dust ingestion intake equation is provided, and the necessary input variables are described. |
| | Metric 5: | Model Inputs and Defaults | High | The model inputs are described, and the values used are provided and cited either to a US EPA exposure factors handbook or to previous peer-reviewed works. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | There is some analysis of variability of the monitoring results, which are used as one of the inputs for the exposure model. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Wei, W., Mandin, C., Blanchard, O., Mercier, F., Pelletier, M., Le Bot, B., Glorennec, P., Ramalho, O. (2019). Semi-volatile organic compounds in French dwellings: An estimation of concentrations in the gas phase and particulate phase from settled dust. Science of the Total Environment 650 Pt. 2:2742-2750. |
| **HERO ID:** | 5043472 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | Medium | Concentration and intermediate equations provided with citations and explanations. |
| | Metric 2: | Model Evaluation | Medium | Validation through comparing predicted and measured values with previous studies in similar environments/conditions; high R2 values for gas phase conc and particular phase equations/values. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Exposure to SVOCs via indoor dust is a relevant and current exposure scenario, but this study and methods are based on data inside French homes. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | Equations all detailed and cited, can be followed to repeat the process. |
| | Metric 5: | Model Inputs and Defaults | High | Inputs to all equations provided and cited where applicable. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | Variability and uncertainty in results discussed for different chemicals based on reported concentrations (secondary data) and equilibrium of gaseous/particulate phases. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Giovanoulis, G., Nguyen, M. A., Arwidsson, M., Langer, S., Vestergren, R., Lagerqvist, A. (2019). Reduction of hazardous chemicals in Swedish preschool dust through article substitution actions. Environment International 130:104921. |
| **HERO ID:** | 5412073 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | Daily intake equation provided and described. No source or citation for the equation but appears scientifically sound. |
| | Metric 2: | Model Evaluation | Low | No discussion of model evaluation in the study, but assumption of some evaluation during peer review process. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Dust exposure in preschools is realistic scenario, but preschools sampled are in Sweden, potentially limiting the comparative value to the US. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | Equation provided to follow calculations of daily intakes. |
| | Metric 5: | Model Inputs and Defaults | Medium | All inputs provided. BW cited to EPA and concentration of dust in the monitoring samples, but ingestion rates not cited. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | Intermediate and high ingestion rates considered, and daily intakes presented for median, mean, and 95th percentile concentrations. Correlation considerations provided in supplemental file. Limited discussion of uncertainties related to monitoring samples used in model. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Luongo, G., Oestman, C. (2016). Organophosphate and phthalate esters in settled dust from apartment buildings in Stockholm. Indoor Air 26(3):414-425. |
| **HERO ID:** | 5469670 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | Medium | No equation is provided but model is described in words and assumed to be: household dust contribution to daily dust intake, as fraction x [(dust ingestion rate x concentration in indoor dust)/bw]. Determinations made using various inputs and defaults for average and high intake scenarios with adults and toddlers agreed with Table 6 reported values. |
| | Metric 2: | Model Evaluation | Medium | Study monitoring data used as inputs were compared with literature values. General calculations for intake values widely used but no validation for their specific scenario. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | This study was conducted in 2008 in Sweden. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | There appears to be sufficient documentation in data source and/or possibly references. |
| | Metric 5: | Model Inputs and Defaults | Medium | Model inputs & defaults are generally identified, referenced and described. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | Average and high estimated daily dust exposures were determined for adults and toddlers with some discussion of uncertainty and limitations. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Promtes, K., Kaewboonchoo, O., Kawai, T., Miyashita, K., Panyapinyopol, B., Kwonpongsagoon, S., Takemura, S. (2019). Human exposure to phthalates from house dust in Bangkok, Thailand. Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 11(13):1-7. |
| **HERO ID:** | 5532759 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | Medium | Daily intake equation is provided with multiple citations, but it is not clear how each source was used or if they all use the same model. |
| | Metric 2: | Model Evaluation | High | Model estimates compared to doses cited from other studies and are compared to US EPA RfDs. References are peer reviewed. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Estimates are based on 2017 concentrations collected in Thailand and ingestion and body weights of Thai adults and children. This may limit the relevance to US exposure scenarios. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | DI equation and needed inputs are provided and sufficient to follow the calculations. |
| | Metric 5: | Model Inputs and Defaults | Medium | Inputs for dust ingestion and body weight are provided, concentrations are reported in table 2. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | Discussion of limitations addressed the sampling methods primarily rather than the modeling methodology. Ingestion exposure estimated based on low-end and high-end rates for three housing scenarios. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | Weiss, J. M., Gustafsson, Å., Gerde, P., Bergman, Å., Lindh, C. H., Krais, A. M. (2018). Daily intake of phthalates, MEHP, and DINCH by ingestion and inhalation. Chemosphere 208:40-49. |
| **HERO ID:** | 5550408 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | All EDI equations were provided with cited references from peer reviewed sources and discussed in detail. |
| | Metric 2: | Model Evaluation | Low | The study does not provide any discussion on model evaluation but some level of validation is assumed based on the study being a peer reviewed article. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | High | This is a Swedish study conducted in 2018 (<5 years ago). Inhalation and ingestion of phthalates from indoor dust is considered a relevant exposure scenario for both children and adults. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | The model equations are clearly defined and and additional documentation is not required to follow how they were used for these exposure scenarios. |
| | Metric 5: | Model Inputs and Defaults | High | The model inputs were referenced and clearly defined along with any assumptions made. Most inputs were retrieved from the child specific exposure factors handbook. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | The study characterized daily intake variability using two age groups (adults and children) and two exposure pathways (incidental ingestion and inhalation). Very limited discussion was provided concerning study uncertainties, limitations, and data gaps. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Lee, I., Alakeel, R., Kim, S., Al-Sheikh, Y. A., Al-Mandeel, H., Alyousef, A. A., Kho, Y., Choi, K. (2019). Urinary phthalate metabolites among children in Saudi Arabia: Occurrences, risks, and their association with oxidative stress markers. Science of the Total Environment 654:1350-1357. |
| **HERO ID:** | 5750962 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | Equation for estimated daily intake of parent phthalate from concentration of urinary phthalate metabolites. Reference citation was also provided (Koch et al. 2007). |
| | Metric 2: | Model Evaluation | Medium | Limited evaluation was evident in terms of comparison with other studies and analytical method validation of input concentrations. It can be assumed that the model has undergone peer evaluation. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Study was conducted in 2017; population was Saudi Arabian children. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | Koch reference is frequently cited for estimated daily intake; documentation is likely available. |
| | Metric 5: | Model Inputs and Defaults | High | Model inputs and defaults are identified, referenced and clearly described. QA/QC concentration data are provided in SI Table S1. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | High | Variability of concentrations was studied and summarized in Table 2. Recommended that study be validated in larger populations using longitudinal study design. |

## Overall Quality Determination High

| | |
|---|---|
| **Study Citation:** | Kim, J. H., Kim, D., Moon, S. M., Yang, E. J. (2020). Associations of lifestyle factors with phthalate metabolites, bisphenol A, parabens, and triclosan concentrations in breast milk of Korean mothers. Chemosphere 249:126149. |
| **HERO ID:** | 6815879 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | Widely accepted daily intake equation, with reference citations from previous studies (Fromme et al. 2010, Kim et al. 2015) |
| | Metric 2: | Model Evaluation | Medium | Model has had limited evaluation with monitoring data. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Study was conducted in 2018, sampling phthalate metabolites in breast milk from mothers in South Korea |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | Sufficient documentation in data sources and companion references. |
| | Metric 5: | Model Inputs and Defaults | Medium | Most model inputs are identified, referenced and described. Breast milk intake was measured but not reported. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | Concentration input data include mean and standard deviation (Table 2). Some uncertainties and data limitations are discussed. |

## Overall Quality Determination Medium

| | |
|---|---|
| **Study Citation:** | SUNY, (2019). Semi-volatile organic compounds in infant homes: Levels, influence factors, partitioning, and implications for human exposure. Environmental Pollution 251:609-618. |
| **HERO ID:** | 6815979 |

| Domain | | Metric | Rating | Comments |
|---|---|---|---|---|
| Domain 1: Reliability | | | | |
| | Metric 1: | Mathematical Equations | High | Equations provided for EDI via air inhalation, air dermal absorption, dust non-dietary ingestion, dust dermal absorption. All equations are described in detail and have citations, some US EPA. |
| | Metric 2: | Model Evaluation | Medium | Model evaluation not directly conducted by author, but models are secondary. Assumed peer review and some evaluation during initial publication. |
| Domain 2: Representative | | | | |
| | Metric 3: | Exposure Scenario | Medium | Model inputs seem appropriate for estimating total daily intakes for infants via dust and air; not all intermediate values provided for each route and the population is limited to the region in China. |
| Domain 3: Accessibility/Clarity | | | | |
| | Metric 4: | Model and Model Documentation Availability | High | Model equations and inputs are sufficient. |
| | Metric 5: | Model Inputs and Defaults | Medium | Inputs are described and values provided with citations; data quality criteria not discussed but values appear appropriate. |
| Domain 4: Variability and Uncertainty | | | | |
| | Metric 6: | Variability and Uncertainty | Medium | The study characterizes the variability in intakes across chemicals but for a single population (infants) and in one scenario (combined air and dust); correlation analysis conducted to identify major routes and influence of each chemical. |

## Overall Quality Determination Medium

Table 669: Glossary of Select Terms for Data Evaluation

| Term | Definition |
|---|---|
| 7Q10 | Lowest 7-day average flow that occurs (on average) once every 10 years |
| 30Q5 | Lowest 30-day average flow that occurs (on average) once every 5 years |
| ADD | Average daily dose |
| ADC | Average daily concentration |
| AERMOD | American Meteorological Society/EPA Regulatory Model |
| AERR | Air Emissions Reporting Requirements |
| AGD | Anogenital distance |
| APDR | Acute Potential Dose Rate |
| BAF | Bioaccumulation factor |
| BBP | Butyl benzyl phthalate |
| BLS | Bureau of Labor Statistics |
| CASRN | Chemical Abstracts Service Registry Number |
| CAP | Criteria Air Pollutants and PreCursors |
| CBI | Confidential business information |
| CDC | Centers for Disease Control and Prevention (U.S.) |
| CDR | Chemical Data Reporting |
| CEHD | Chemical Exposure Health Data |
| CEM | Consumer Exposure Model |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| COC | Concentration of concern |
| CPSC | Consumer Product Safety Commission |
| CRA | Cumulative risk assessment |
| CWA | Clean Water Act |
| DBP | Dibutyl phthalate |
| DCHP | Dicyclohexyl phthalate |
| DEHP | Diethylhexyl phthalate |
| DIBP | Diisobutyl phthalate |
| DIDP | Diisodecyl phthalate |
| DINP | Dicyclohexyl phthalate |
| DIY | Do-it-yourself |
| DMR | Discharge Monitoring Report |
| ECJRC | European Commission's Joint Research Centre |
| EPA | Environmental Protection Agency |
| EPCRA | Emergency Planning and Community Right-to-Know Act |
| ESD | Emission scenario document |

**Continued on next page . . .**

**Table 669 . . . continued from previous page**

| Term | Definition |
|---|---|
| EU | European Union |
| FDA | Food and Drug Administration |
| FFDCA | Federal Food, Drug, and Cosmetic Act |
| GWPC | Ground Water Protection Council |
| HAP | Hazardous Air Pollutant |
| HEC | Human equivalent concentration |
| HED | Human equivalent dose |
| HV | Hazard value |
| IADD | Intermediate average daily dose |
| IIOAC | Integrated Indoor-Outdoor Air Calculator (Model) |
| IR | Ingestion rate |
| $K_{OC}$ | Soil organic carbon: water partitioning coefficient |
| $K_{OW}$ | Octanol: water partition coefficient |
| LCD | Life cycle diagram |
| LOAEL | Lowest-observed-adverse-effect level |
| LOD | Limit of detection |
| LOEC | Lowest-observed-effect concentration |
| Log $K_{OC}$ | Logarithmic organic carbon: water partition coefficient |
| Log $K_{OW}$ | Logarithmic octanol: water partition coefficient |
| MBP | Monobutyl phthalate |
| MOA | Mode of action |
| MOE | Margin of exposure |
| MRD | Methodology Review Draft |
| NAICS | North American Industry Classification System |
| NEI | National Emissions Inventory |
| NHANES | National Health and Nutrition Examination Survey |
| NHDPlus | National Hydrography Dataset Plus |
| NICNAS | National Industrial Chemicals Notification and Assessment Scheme |
| NOAEL | No-observed-adverse-effect level |
| NOEC | No-observed-effect-concentration |
| NPDES | National Pollutant Discharge Elimination System |
| NTP | National Toxicology Program |
| OCSPP | Office of Chemical Safety and Pollution Prevention |
| OECD | Organisation for Economic Co-operation and Development |
| OEL | Occupational exposure limit |
| OES | Occupational exposure scenario |
| OEV | Occupational exposure value |
| ONU | Occupational non-user |
| OPPT | Office of Pollution Prevention and Toxics |
| OSHA | Occupational Safety and Health Administration |
| P50 | The 50th percentile or median flow rate of a distribution of hydrologic flows |

**Continued on next page . . .**

**Table 669 . . . continued from previous page**

| Term | Definition |
|---|---|
| P75 | The 75th percentile flow rate of a distribution of hydrologic flows |
| P90 | The 90th percentile flow rate of a distribution of hydrologic flows |
| PBZ | Personal breathing zone |
| PECO | Population, exposure, comparator, and outcome |
| PEL | Permissible exposure limit (OSHA) |
| PESS | Potentially exposed or susceptible subpopulations |
| PND | Postnatal day |
| PNOR | Particulates not otherwise regulated |
| POD | Point of departure |
| POTW | Publicly owned treatment works |
| PPAR$\alpha$ | Peroxisome proliferator activated receptor alpha |
| PSC | Point Source Calculator (for VVWM) |
| PV | Production volume |
| PVC | Polyvinyl chloride |
| REL | Recommended Exposure Limit |
| RPF | Relative potency factor |
| RQ | Risk quotient |
| SACC | Science Advisory Committee on Chemicals |
| SDS | Safety data sheet |
| SOC | Standard occupational classification |
| SpERC | Specific emission release category |
| SSD | Species sensitivity distribution |
| SUSB | Statistics of U.S. Businesses (U.S. Census) |
| TRI | Toxic Release Inventory |
| TRV | Toxicity reference value |
| TSCA | Toxic Substances Control Act |
| TSD | Technical support document |
| TWA | Time-weighted average |
| UF | Uncertainty factor |
| U.S. | United States |
| VVWM-PSC | Variable Volume Water Model with Point Source Calculator tool |
| WebFIRE | Web Factor Information Retrieval (FIRE) Data System |
| WORA | Women of reproductive age |
| WWTP | Wastewater treatment plant |