How Does ORD's Research Improve EPA's Understanding of Children's Exposures and Risks?

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Contributing Organizations: ORD: NERL, NCER, NHEERL; Johns Hopkins University; Harvard University; University of California, Berkeley; University of Washington; Columbia University; University of Medicine and Dentistry of New Jersey

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LTG 3 Poster 01

Science Questions

•Are some infants and children exposed to higher levels of environmental contaminants than other infants and children? Are some infants and children more susceptible than other infants and children?
•If some infants and children are more highly exposed to environmental contaminants, how and why are these infants and children exposed?
•Why are infants and children more susceptible than adults to the toxic effects of environmental contaminants?
•What are the long-term effects of developmental exposure to environmental contaminants?

Research Goals

The overall goal of this research is to understand the exposure, susceptibility and differential risks of children to environmental contaminants. This poster highlights selected intramural and extramural components of ORD's children's research program. ORD develops tools, methods, study designs, and approaches that can be used for cross-sectional and longitudinal observational exposure and epidemiologic studies of children's environmental health.

Highlights of Findings and Conclusions

•Developed a systematic data collection approach to estimate children's aggregate and cumulative exposures to pesticides and other chemicals found in the non-occupational environment.

•Developed a comprehensive database for understanding children's exposures to multiple chemicals.
•Developed biological measurements to show that children are exposed to chemicals *in utero*.

•Demonstrated that socioeconomic status and residential environments do influence exposures to various environmental contaminants.
•Demonstrated that certain groups of children may be more than 65 times more genetically vulnerable to the effects of organophosphate pesticides than other children.

•Demonstrated that children's exposures to certain classes of chemicals do have an effect on weight, birth outcomes, mental development, and memory.
•Tested and validated animal models for extrapolating effects to human children.

•Produced direct human evidence that the ban on chlorpyrifos and diazinon was protective of children's health.

Highlights from our Children's Cohorts

EXPOSURE RESEARCH (poster 3-03)

Studies are designed to:
•Evaluate exposure factors for children ranging in age from newborn to 7 years
•Characterize chemical distributions in locations where young children spend time
•Identify exposure pathways and exposure factors for young children
•Link exposures to health effects

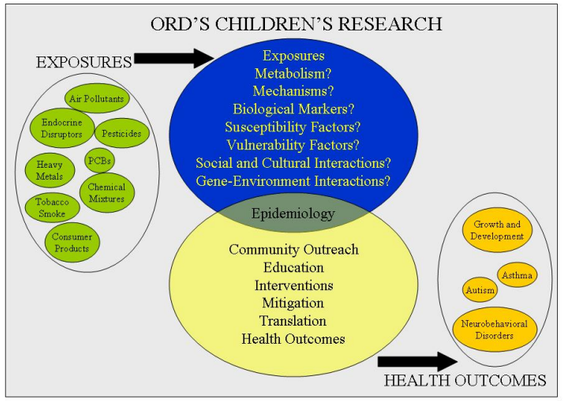
Children's Total Exposure to Persistent Pesticides and Other Persistent Organic Pollutants Study (CTEPP), Marsha Morgan, ORD. (N=260).

Biological and Environmental Monitoring for Organophosphate and Pyrethroid Exposures in Children Living in Jacksonville, Florida, Nicolle Tulve et al., ORD. (N=203).

Pesticide Exposure Pathways for Farmworker's Children in Yakima Valley, Washington, Center for Child Environmental Health Risks Research, Elaine Faustman et al., University of Washington. (N=218).

Mothers and Newborns Study, a **longitudinal birth cohort** of the Columbia Center for Children's Environmental Health, Frederica Perera et al., Columbia University. (N=230).

Exposures and Health of Farm Worker Children in California, Center for Children's Environmental Health Research, Brenda Eskenazi et al., University of California, Berkeley. (528 women/482 children).



EFFECTS AND SUSCEPTIBILITY (posters 3-02, 3-05, and 2-09)

Studies are designed to:
•Link exposures to health effects
•Evaluate health effects for children aged 6 months to 13 years
•Evaluate neurobehavioral development in children
•Evaluate growth and other developmental outcomes in children
•Evaluate tools to understand health impacts

Cholinesterase in Children's Saliva, Sue McMaster et al., ORD. (N=40).

Border Health Project – Neurobehavioral Component, Sue McMaster et al., ORD. (N=50).

Mechanistic Indicators of Childhood Asthma (MICA), Mary Johnson and Ron Williams et al., ORD. (N=92).

Center for Childhood Neurotoxicology and Assessment, George Lambert et al., University of Medicine and Dentistry of New Jersey.

Genetic Susceptibility to Pesticides, Center for Child Environmental Health Risks Research, Elaine Faustman et al., University of Washington.

PON1 as a Predictor of Differential Susceptibility of Children to Organophosphate Pesticides, Center for Children's Environmental Health Research, Brenda Eskenazi et al., University of California, Berkeley.

Growth and Development/Evaluation of Carcinogenic Risks, Columbia Center for Children's Environmental Health, Frederica Perera et al., Columbia University. (N=230).

COMMUNITY ENGAGEMENT AND OUTREACH

Community partners play a critical role in informing, implementing, and translating children's environmental health research into knowledge and actions that benefit the community's health.

Benefits of CBPR include:
•Enhanced data quality and quantity, relevance of collected data, and information dissemination.
•Improved research definition and direction, clearer understanding of research questions, and improved identification of ethical dilemmas.
•Enhanced translation of research into policy.
• Knowledge that benefits the community's health, education and economics bringing additional resources and services to a community (e.g., training).
•Increased trust of community residents towards funding agencies and academic researchers.

Examples:
•Columbia's collaboration with NYC's Housing Authority and the NYC DOH on a low-toxicity pesticide intervention in public housing. Impact: Adoption and implementation of integrated pest management in public housing.
•UW children's health research center's assessment of pesticide levels in vehicle dust as it relates to the take-home exposure pathway. Impact: Linked the take-home pathway to children's exposures at home through correlations with both house dust and children's urinary pesticide metabolites.

EXTRAPOLATION BETWEEN ANIMAL AND HUMAN STUDIES (posters 3-02, 3-06, 3-04, and 3-08)

Animal studies are designed to:
•Complement epidemiological studies
•Evaluate genetic or molecular factors
•Support model development for human systems, including the National Children's Study

Center for Childhood Asthma in the Urban Environment, Patrick Breysse et al., Johns Hopkins University.

Metal Mixtures and Children's Health, Joseph Brain et al., Harvard University.

Developmental Origins of Adult Disease, John Rogers et al., ORD

Impact and Outcomes

ORD's extensive children's exposure and health effects research contributes data to EPA Program Offices and NCEA's Exposure Factors Handbooks for use in risk assessments. Understanding children's exposures and susceptibility helps EPA risk assessors define uncertainty factors rather than using default values and provides the scientific basis for assessing cumulative risks in communities (poster 2-10, 2-11).

Examples of impacts:
•Supported OPP's cumulative risk assessments for the OPs and carbamates (poster 2-04) and pyrethroids (poster 2-05).
•Used to support California legislation limiting siting of new schools in proximity to major roadways.
•Contributed to EPA's decision to ban the use of chlorpyrifos and diazinon.
•Informed parents and communities on how to reduce exposures.

Future Directions

•Expand focus on cumulative risks and community risk assessment for children, including consideration of non-chemical stressors.
•Identify the sources of those chemicals and non-chemical stressors.
•Understand the routes and pathways of exposure.
•Determine the exposure factors that have the greatest impact on children's exposures in their everyday environments, as they go about their normal activities.
•Determine how to reduce these exposures for children.
•Support research on the impact of environmental factors in complex chronic childhood illnesses and adverse birth outcomes.

Contributors

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Susceptible Populations

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