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# Update for Chapter 3 of the Exposure Factors Handbook

*Ingestion of Water and Other Select Liquids*

National Center for Environmental Assessment
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U.S. Environmental Protection Agency
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**TABLE OF CONTENTS**

LIST OF TABLES ..... 3-vi
LIST OF FIGURES ..... 3-ix

3. INGESTION OF WATER AND OTHER SELECT LIQUIDS ..... 3-1
3.1. INTRODUCTION ..... 3-1
3.2. RECOMMENDATIONS ..... 3-2
3.2.1. Water Ingestion from Consumption of Water as a Beverage and from Food and Drink ..... 3-2
3.2.2. Pregnant and Lactating Women ..... 3-2
3.2.3. Formula-Fed Infants ..... 3-3
3.2.4. Water Ingestion While Swimming or Diving ..... 3-3
3.3. DRINKING WATER INGESTION STUDIES ..... 3-13
3.3.1. Key Drinking Water Ingestion Study for the General Population ..... 3-13
3.3.1.1. U.S. EPA Analysis of NHANES 2005−2010 Data ..... 3-13
3.3.2. Relevant Drinking Water Ingestion Studies for the General Population ..... 3-14
3.3.2.1. Wolf (1958)—Body Water Content ..... 3-14
3.3.2.2. National Research Council (1977)—Drinking Water and Health ..... 3-14
3.3.2.3. Pennington (1983)—Revision of the Total Diet Study Food List and Diets ..... 3-15
3.3.2.4. U.S. EPA (1984)—An Estimation of the Daily Average Food Intake by Age and Sex for Use in Assessing the Radionuclide Intake of the General Population ..... 3-15
3.3.2.5. Cantor et al. (1987)—Bladder Cancer, Drinking Water Source, and Tap Water Consumption ..... 3-15
3.3.2.6. Ershow and Cantor (1989)—Total Water and Tap Water Intake in the United States: Population-Based Estimates of Quantities and Sources ..... 3-16
3.3.2.7. Roseberry and Burmaster (1992)—Lognormal Distributions for Water Intake ..... 3-16
3.3.2.8. Levy et al. (1995)—Infant Fluoride Intake from Drinking Water Added to Formula, Beverages, and Food ..... 3-17
3.3.2.9. USDA (1995)—Food and Nutrient Intakes by Individuals in the United States, 1 Day, 1989−1991 ..... 3-17
3.3.2.10. U.S. EPA (1996)—Descriptive Statistics from a Detailed Analysis of the National Human Activity Pattern Survey (NHAPS) Responses ..... 3-18
3.3.2.11. Heller et al. (2000)—Water Consumption and Nursing Characteristics of Infants by Race and Ethnicity ..... 3-18
3.3.2.12. Marshall et al. (2003a)—Patterns of Beverage Consumption during the Transition Stage of Infant Nutrition ..... 3-19
3.3.2.13. Marshall et al. (2003b)—Relative Validation of a Beverage Frequency Questionnaire in Children Aged 6 Months through 5 Years Using 3-Day Food and Beverage Diaries ..... 3-20
3.3.2.14. Skinner et al. (2004)—Transition in Infants' and Toddlers' Beverage Patterns ..... 3-20
3.3.2.15. Barraj et al. (2009)—Within-Day Drinking Water Consumption Patterns: Results from a Drinking Water Consumption Study ..... 3-20
3.3.2.16. Zizza et al. (2009)—Total Water Intakes of Community-Living Middle-Old and Oldest-Old Adults ..... 3-21
3.3.2.17. Sebastian et al. (2011)—Drinking Water Intake in the United States; Rosinger et al. (2016)—Daily Water Intake among U.S. Men and Women, 2009−2012 ..... 3-21

**TABLE OF CONTENTS (CONTINUED)**

3.3.2.18. Kahn and Stralka (2009)—Estimated Daily Average per Capita Water Ingestion by Child and Adult Age Categories Based on USDA's 1994−1996 and 1998 Continuing Survey of Food Intakes by Individuals and Supplemental Data, Kahn (2008) ..... 3-22
3.4. PREGNANT AND LACTATING WOMEN ..... 3-23
3.4.1. Key Study on Pregnant and Lactating Women ..... 3-23
3.4.1.1. EPA Analysis of Consumption Data from 2005−2010 National Health and Nutrition Examination Survey ..... 3-23
3.4.2. Relevant Studies on Pregnant and Lactating Women ..... 3-23
3.4.2.1. Ershow et al. (1991)—Intake of Tap Water and Total Water by Pregnant and Lactating Women ..... 3-23
3.4.2.2. Shimokura et al. (1998)—Assessment of Water Use for Estimating Exposure to Tap Water Contaminants ..... 3-24
3.4.2.3. Zender et al. (2001)—Exposure to Tap Water during Pregnancy ..... 3-24
3.4.2.4. Forssén et al. (2007)—Predictors of Use and Consumption of Public Drinking Water among Pregnant Women; Forssén et al. (2009)—Variability and Predictors of Changes in Water Use during Pregnancy ..... 3-24
3.4.2.5. Kahn and Stralka (2008)—Estimates of Water Ingestion for Women in Pregnant, Lactating, and Nonpregnant and Nonlactating Child-Bearing Age Groups Based on USDA's 1994−1996, 1998 CSFII ..... 3-25
3.5. FORMULA-FED INFANTS ..... 3-25
3.5.1. Key Study on Formula-Fed Infants ..... 3-25
3.5.1.1. Kahn et al. (2013)—Estimates of Water Ingestion in Formula by Infants and Children Based on USDA's 1994−1996 and 1998 Continuing Survey of Food Intakes by Individuals ..... 3-25
3.5.2. Relevant Studies on Formula-Fed Infants ..... 3-25
3.5.2.1. Hilbig et al. (2002)—Measured Consumption of Tap Water in German Infants and Young Children as Background for Potential Health Risk Assessment: Data of the DONALD Study ..... 3-26
3.5.2.2. Levallois et al. (2008)—Drinking Water Intake by Infants Living in Rural Quebec (Canada) ..... 3-26
3.5.2.3. Schier et al. (2010)—Perchlorate Exposure from Infant Formula and Comparisons with the Perchlorate Reference Dose ..... 3-26
3.6. HIGH ACTIVITY LEVELS/HOT CLIMATES ..... 3-27
3.6.1. Relevant Studies on High Activity Levels/Hot Climates ..... 3-27
3.6.1.1. McNall and Schlegel (1968)—Practical Thermal Environmental Limits for Young Adult Males Working in Hot, Humid Environments ..... 3-27
3.6.1.2. U.S. Army (1983, 1999)—Water Consumption Planning Factors ..... 3-27
3.6.1.3. Sohn et al. (2001)—Fluid Consumption Related to Climate among Children in the United States ..... 3-28
3.6.1.4. Kant et al. (2009)—Intakes of Plain Water, Moisture in Foods and Beverages, and Total Water in the Adult U.S. Population—Nutritional, Meal Pattern, and Body Weight Correlates: NHANES 1999−2006; Kant and Graubard (2010)—Contributors of Water Intake in U.S. Children and Adolescents: Associations with Dietary and Meal Characteristics—National Health and Nutrition Examination Survey 2005−2006 ..... 3-28
3.6.1.5. Yang and Chun (2014)—Consumptions of Plain Water, Moisture in Foods and Beverages, and Total Water in Relation to Dietary Micronutrient Intakes and Serum Nutrient Profiles among U.S. Adults ..... 3-29
3.6.1.6. Montain and Ely (2010)—Water Requirements and Soldier Hydration ..... 3-29
3.7. WATER INGESTION WHILE SWIMMING AND DIVING ..... 3-30

**TABLE OF CONTENTS (CONTINUED)**

3.7.1. Key Studies on Water Ingestion While Swimming ..... 3-30
3.7.1.1. Dufour et al. (2006)—Water Ingestion during Swimming Activities in a Pool: A Pilot Study; Dufour et al. (2017)—Ingestion of Swimming Pool Water by Recreational Swimmers ..... 3-30
3.7.2. Relevant Studies on Water Ingestion While Swimming, Diving, or Engaging in Recreational Water Activities ..... 3-31
3.7.2.1. Schijven and de Roda Husman (2006)—A Survey of Diving Behavior and Accidental Occupational and Sport Divers to Assess the Risk of Infection with Waterborne Pathogenic Microorganisms ..... 3-31
3.7.2.2. Schets et al. (2011)—Exposure Assessment for Swimmers in Bathing Waters and Swimming Pools ..... 3-31
3.7.2.3. Dorevitch et al. (2011)—Water Ingestion during Water Recreation ..... 3-32
3.7.2.4. Suppes et al. (2014)—Assessment of Swimmers Behaviors on Pool Water Ingestion ..... 3-32
3.7.2.5. Sinclair et al. (2016a)—Variability in 24-Hour Excretion of Cyanuric Acid: Implications for Water Exposure Assessment ..... 3-33
3.7.2.6. DeFlorio-Barker et al. (2017)—Child Environmental Exposures to Water and Sand at the Beach: Findings from Studies of Over 68,000 Subjects at 12 Beaches ..... 3-33
3.8. OTHER INADVERTENT WATER INGESTION ..... 3-33
3.8.1. Sinclair et al. (2016b)—Measuring Water Ingestion from Spray Exposures ..... 3-33
3.9. REFERENCES FOR CHAPTER 3 ..... 3-34

APPENDIX A ..... A-1
APPENDIX B ..... B-1

**LIST OF TABLES**

Table 3-1. Recommended Values for Drinking Water Ingestion Rates ....3-4
Table 3-2. Confidence in Recommendations for Drinking Water Ingestion Rates ....3-6
Table 3-3. Recommended Values for Water Ingestion Rates of Community Water for Pregnant and Lactating Women, and Women of Child-bearing Age....3-7
Table 3-4. Confidence in Recommendations for Water Ingestion for Pregnant/Lactating Women ....3-8
Table 3-5. Recommended Values for Water Ingestion Rates of Community Water for Formula-Fed Infants ....3-9
Table 3-6. Confidence in Recommendations for Water Ingestion for Formula-Fed Infants ....3-10
Table 3-7. Recommended Values for Water Ingestion While Swimming ....3-11
Table 3-8. Confidence in Recommendations for Water Ingestion While Swimming ....3-12
Table 3-9. Two-Day Average per Capita Estimates of Combined Direct and Indirect Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Community Water....3-38
Table 3-10. Two-Day Average per Capita Estimates of Direct Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Bottled Water....3-40
Table 3-11. Two-Day Average per Capita Estimates of Combined Direct and Indirect Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Other Sources....3-42
Table 3-12. Two-Day Average per Capita Estimates of Combined Direct and Indirect Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: All Sources....3-44
Table 3-13. Two-Day Average per Capita Estimates of Combined Direct and Indirect Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Community Water....3-46
Table 3-14. Two-Day Average per Capita Estimates of Direct Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Bottled ....3-48
Table 3-15. Two-Day Average per Capita Estimates of Combined Direct and Indirect Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Other Sources....3-50
Table 3-16. Two-Day Average per Capita Estimates of Combined Direct and Indirect Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: All Sources....3-52
Table 3-17. Two-Day Average Consumer-Only Estimates of Combined Direct and Indirect Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Community Water....3-54
Table 3-18. Two-Day Average Consumer-Only Estimates of Direct Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Bottled Water....3-56
Table 3-19. Two-Day Average Consumer-Only Estimates of Combined Direct and Indirect Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Other Sources....3-58
Table 3-20. Two-Day Average Consumer-Only Estimates of Combined Direct and Indirect Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: All Sources....3-60
Table 3-21. Two-Day Average Consumer-Only Estimates of Combined Direct and Indirect Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Community Water....3-62
Table 3-22. Two-Day Average Consumer-Only Estimates of Direct Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Bottled Water....3-64
Table 3-23. Two-Day Average Consumer-Only Estimates of Combined Direct and Indirect Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Other Sources....3-66

**LIST OF TABLES (CONTINUED)**

Table 3-24. Two-Day Average Consumer-Only Estimates of Combined Direct and Indirect Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: All Sources....3-68
Table 3-25. Intake Rates of Total Fluids and Total Tap Water by Age Group....3-70
Table 3-26. Mean and Standard Error (SE) for the Daily Intake of Beverages and Tap Water by Age....3-70
Table 3-27. Average Total Tap Water Intake Rate by Sex, Age, and Geographic Area....3-71
Table 3-28. Frequency Distribution of Total Tap Water Intake Rates....3-71
Table 3-29. Total Tap Water Intake (mL/day) for Both Sexes Combined....3-72
Table 3-30. Total Tap Water Intake (mL/kg-day) for Both Sexes Combined....3-73
Table 3-31. Total Tap Water Intake (as % of total water intake) by Broad Age Category....3-74
Table 3-32. General Dietary Sources of Tap Water for Both Sexes....3-74
Table 3-33. Summary Statistics for Best-Fit Lognormal Distributions for Water Intake Rates....3-75
Table 3-34. Estimated Quantiles and Means for Total Tap Water Intake Rates....3-76
Table 3-35. Water Ingested (mL/day) from Water by Itself and Water Added to Other Beverages and Foods....3-77
Table 3-36. Mean per Capita Drinking Water Intake Based on U.S. Department of Agriculture (USDA), Continuing Survey of Food Intake by Individuals (CSFII) Data from 1989−1991....3-79
Table 3-37. Number of Respondents Who Consumed Tap Water at a Specified Daily Frequency....3-80
Table 3-38. Number of Respondents Who Consumed Juice Reconstituted with Tap Water at a Specified Daily Frequency....3-81
Table 3-39. Mean and (standard error [SE]) Water and Drink Consumption (mL/kg-day) by Race/Ethnicity....3-83
Table 3-40. Plain Tap Water and Total Water Consumption by Age, Sex, Region, Urbanicity, and Poverty Category....3-84
Table 3-41. Percentage of Subjects Consuming Beverages and Mean Daily Beverage Intakes (mL/day) for Children with Returned Questionnaires....3-85
Table 3-42. Mean (± standard deviation [SD]) Daily Beverage Intakes Reported on Beverage Frequency Questionnaire and 3-Day Food and Beverage Diaries....3-87
Table 3-43. Consumption of Beverages by Infants and Toddlers....3-88
Table 3-44. Number of Drinking Water Events Per Day, Intake Per Event (mL/event), and Daily Intake....3-89
Table 3-45. Mean (standard error [SE]) Total Daily Water Intake for Older Adults....3-90
Table 3-46. Per Capita Estimates of Combined Direct and Indirect Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Community Water....3-90
Table 3-47. Per Capita Estimates of Combined Direct and Indirect Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Bottled Water....3-91
Table 3-48. Per Capita Estimates of Combined Direct and Indirect Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Other Sources....3-92
Table 3-49. Per Capita Estimates of Combined Direct and Indirect Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): All Sources....3-93
Table 3-50. Per Capita Estimates of Combined Direct and Indirect[b] Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Community Water....3-94
Table 3-51. Per Capita Estimates of Combined Direct and Indirect Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Bottled Water....3-95
Table 3-52. Per Capita Estimates of Combined Direct and Indirect Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Other Sources....3-96

**LIST OF TABLES (CONTINUED)**

Table 3-53. Per Capita Estimates of Combined Direct and Indirect Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): All Sources .....3-97
Table 3-54. Consumers-Only Estimates of Combined Direct and Indirect Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Community Water.....3-98
Table 3-55. Consumers-Only Estimates of Combined Direct and Indirect Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Bottled Water.....3-99
Table 3-56. Consumers-Only Estimates of Combined Direct and Indirect Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Other Sources.....3-100
Table 3-57. Consumers-Only Estimates of Combined Direct and Indirect Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): All Sources.....3-101
Table 3-58. Consumers-Only Estimates of Direct and Indirect Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Community Water.....3-102
Table 3-59. Consumers-Only Estimates of Direct and Indirect Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Bottled Water.....3-103
Table 3-60. Consumers-Only Estimates of Direct and Indirect Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Other Sources.....3-104
Table 3-61. Consumers-Only Estimates of Direct and Indirect Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): All Sources.....3-105
Table 3-62. Two-Day Average per Capita Drinking Water Intake: Pregnant and Lactating Women, and Women of Child-Bearing Age.....3-106
Table 3-63. Two-Day Average Consumer-Only Drinking Water Intake: Pregnant and Lactating Women, and Women of Child-Bearing Age.....3-108
Table 3-64. Total Fluid Intake of Women 15 to 49 Years Old.....3-110
Table 3-65. Total Tap Water Intake of Women 15 to 49 Years Old.....3-110
Table 3-66. Total Fluid (mL/Day) Derived from Various Dietary Sources by Women Aged 15 to 49 Years.....3-111
Table 3-67. Daily Water Intake for Men and Pregnant Women.....3-111
Table 3-68. Average Daily Tap Water Consumption (L/day) by Location, Temperature, and Beverage Type.....3-112
Table 3-69. Water Ingestion Rates by Pregnancy Status (L/day) and Source Location.....3-113
Table 3-70. Principal Sources of Drinking Water at Home for Pregnant and Nonpregnant Women.....3-114
Table 3-71. Total Tap Water and Bottled Water Intake by Pregnant Women.....3-115
Table 3-72. Percentage of Mean Water Intake Consumed as Unfiltered and Filtered Tap Water by Pregnant Women.....3-118
Table 3-73. Intake Rates at Different Times During Pregnancy.....3-120
Table 3-74. Frequency and Proportion of Women Reporting Changes in Water Intake between Early and Mid-Pregnancy.....3-121
Table 3-75. Per Capita Estimates of Direct and Indirect Water Intake from All Sources by Pregnant, Lactating, and Child-Bearing Age Women.....3-122
Table 3-76. Per Capita Estimates of Direct and Indirect Water Intake from All Sources by Pregnant, Lactating, and Child-Bearing Age Women.....3-122
Table 3-77. Per Capita Estimated Direct and Indirect Community Water Ingestion by Pregnant, Lactating, and Child-Bearing Age Women.....3-123
Table 3-78. Per Capita Estimated Direct and Indirect Community Water Ingestion by Pregnant, Lactating, and Child-Bearing Age Women.....3-123
Table 3-79. Consumers-Only Estimated Direct and Indirect Water Intake from All Sources by Pregnant, Lactating, and Child-Bearing Age Women.....3-124
Table 3-80. Consumers-Only Direct and Indirect Water Intake from All Sources by Pregnant, Lactating, and Child-Bearing Age Women.....3-124

**LIST OF TABLES (CONTINUED)**

Table 3-81. Consumers-Only Estimated Direct and Indirect Community Water Ingestion by Pregnant, Lactating, and Child-Bearing Age Women....3-125
Table 3-82. Consumers-Only Estimated Direct and Indirect Community Water Ingestion by Pregnant, Lactating, and Child-Bearing Age Women....3-125
Table 3-83. Mean and 95th Percentile Community Water Intake among Formula-Fed Infants....3-126
Table 3-84. Tap Water Intake in Breast-Fed and Formula-Fed Infants and Mixed-Fed Young Children at Different Age Points....3-127
Table 3-85. Water Intake for 2-Month-Old Infants....3-129
Table 3-86. Water Intake at Various Activity Levels....3-130
Table 3-87. Planning Factors for Individual Tap Water Consumption....3-130
Table 3-88. Mean (± standard error [SE]) Fluid Intake (mL/kg-day) by Children Aged 1 to 10 Years, National Health and Nutrition Examination Survey (NHANES) III, 1988−1994....3-131
Table 3-89. Estimated Mean (± standard error [SE]) Amount of Total Fluid and Plain Water Intake among Children Aged 1 to 10 Years by Age, Sex, Race/Ethnicity, Poverty:Income Ratio, Region, and Urbanicity....3-132
Table 3-90. Daily Water Intake Based on Physical Activity Levels, Mean ± Standard Error (SE) g/day....3-134
Table 3-91. Pool Water Ingestion by Swimmers....3-135
Table 3-92. Swimming Pool Water Ingestion Rates (mL/hour) by Swimmer Groups....3-135
Table 3-93. Water Ingested while Swimming....3-135
Table 3-94. Arithmetic Mean (maximum) Number of Dives per Diver and Volume of Water Ingested....3-136
Table 3-95. Exposure Parameters for Swimmers in Swimming Pools, Fresh Water, and Seawater....3-137
Table 3-96. Estimated Water Ingestion during Water Recreation Activities....3-137
Table 3-97. Pool Water Ingestion (mL/hr) by Activity and Age Group among Videotaped Participants....3-138
Table 3-98. Estimated Volume of Water Ingested per Swimming Event....3-138
Table A-1. Comparison of Community Water Intake Estimates 1994−1998 Continuing Survey of Food Intake by Individuals (CFSII), National Health and Nutrition Examination Survey (NHANES) 2003−2006, and NHANES 2005−2010....A-1
Table A-2. Comparison of Bottled Water Intake Estimates 1994−1998 Continuing Survey of Food Intake by Individuals (CFSII), National Health and Nutrition Examination Survey (NHANES) 2003−2006, and NHANES 2005−2010....A-3
Table A-3. Comparison of Other Sources of Water Intake Estimates 1994−1998 Continuing Survey of Food Intake by Individuals (CFSII), National Health and Nutrition Examination Survey (NHANES) 2003−2006, and NHANES 2005−2010....A-5
Table A-4. Comparison of All Sources of Water Intake Estimates 1994−1998 Continuing Survey of Food Intake by Individuals (CFSII), National Health and Nutrition Examination Survey (NHANES) 2003−2006, and NHANES 2005−2010....A-7
Table B-1. Terms Used in Literature Searches....B-1

**LIST OF FIGURES**

Figure A-1. Comparison of mean per capita water ingestion (mL/day), all ages: Continuing Survey of Food Intake by Individuals (CSFII) 1994−1996, 1998; National Health and Nutrition Examination Survey (NHANES) 2003−2006, and NHANES 2005−2010....A-9

# 3. INGESTION OF WATER AND OTHER SELECT LIQUIDS

## 3.1. INTRODUCTION

This document is an update to Chapter 3 (Ingestion of Water and Selected Liquids) of the *Exposure Factors Handbook; 2011 Edition* (U.S. EPA, 2011). New information that has become available since 2011 has been added, and the recommended values have been revised as needed to reflect the additional information. The recommended values for the general population in this chapter have been updated using National Health and Nutrition Examination Survey (NHANES) data for 2005−2010; the 2011 version of this chapter used NHANES data for 2003−2006 for individuals ≥3 years of age and Continuing Survey of Food Intake by Individuals (CSFII) data for 1994-1996, and 1998 for children <3 years of age. Appendix A provides a comparison of the intake rates based on NHANES 2005-2010 data to those based on NHANES 2003-2006 and CSFII 1994-96 and 1998. Data for pregnant and lactating women have also been updated using NHANES 2005-2010 data. This update also provides, for the first time, water intake data for formula-fed infants. Recent relevant studies based on data other than NHANES and CSFII are also summarized to provide additional perspective on drinking water intake.

The chapter includes a comprehensive review of the scientific literature through 2017. The new literature was identified via formal literature searches conducted by EPA library services as well as targeted internet searches conducted by the authors of this chapter. Appendix B provides a list of the key terms that were used in the literature searches. Revisions to this chapter have been made in accordance with the approved quality assurance plan for the *Exposure Factors Handbook*.

Water ingestion is a pathway of exposure to environmental chemicals. Contamination of water may occur at the water supply source (groundwater or surface water); during treatment (for example, toxic by-products may be formed during chlorination); or post-treatment (such as leaching of lead or other materials from plumbing systems). People may be exposed to contaminants in water when consuming water directly as a beverage, indirectly from foods and drinks made with water, or incidentally while swimming or engaging in other water-related activities. Estimating the magnitude of the potential dose of toxics from water ingestion requires information on the quantity of water consumed. The purpose of this section is to describe key and relevant published studies that provide information on water ingestion for various populations and to provide recommended ingestion rate values for use in exposure assessments. As described in Chapter 1 of the *Exposure Factors Handbook: 2011 Edition* (U.S. EPA, 2011), key studies represent those studies that are the most up-to-date and scientifically sound for deriving recommendations for exposure factors, whereas other studies are designated "relevant," meaning applicable or pertinent, but not necessarily the most important. For example, studies that provide supporting data or information related to the factor of interest (e.g., number of drinking events per day), or have study designs or approaches that make the data less applicable to the population of interest (e.g., studies not conducted in the United States) have been designated as relevant rather than key. Key studies were selected based on the general assessment factors described in Chapter 1 of the handbook. The studies described in this section provide information on ingestion of water consumed as a beverage or in foods or beverages containing tap water, ingestion of other select liquids, and ingestion of water while swimming.

Historically, the Environmental Protection Agency (EPA) has assumed a drinking water ingestion rate of 2 L/day for adults and 1 L/day for infants and children under 10 years of age (U.S. EPA, 2000a). This rate includes water consumed in the form of juices and other beverages containing tap water. The National Research Council (NRC, 1977) estimated that daily consumption of water may vary with levels of physical activity and fluctuations in temperature and humidity. It is reasonable to assume that people engaging in physically demanding activities or living in warmer regions may have higher levels of water ingestion. However, there is limited information on the effects of activity level and climatic conditions on water ingestion.

U.S. EPA's analysis of 2005−2010 data from the NHANES was selected as the key study of drinking water ingestion for the general population and for pregnant and lactating women. NHANES 2005−2010 contains the most up-to-date information on water intake rate estimates. Kahn et al. (2013) was selected as a key study for formula-fed infants. Kahn et al. (2013) used data from U.S. Department of Agriculture's (USDA's) 1994−1996, 1998 CSFII.

The U.S. EPA analysis of NHANES data and the analyses of CSFII data by Kahn et al. (2013) generated ingestion rates for direct and indirect ingestion of water. Direct ingestion is defined as direct consumption of water as a beverage, while indirect ingestion includes water added during food or beverage preparation, but not water intrinsic to purchased foods (i.e., water that is naturally contained in foods) (Kahn and Stralka, 2008). Data for

consumption of water from various sources (i.e., the community water supply, bottled water, and other sources) are also presented. It is noted that the type of water people drink has changed in the last decade, as evidenced by the increase in bottled water consumption (see Appendix A). However, the majority of the U.S. population consumes water from public (i.e., community) water distribution systems; about 15% of the U.S. population obtains their water from private (i.e., household) wells, cisterns, or springs (U.S. EPA, 2002; https://www.epa.gov/privatewells/about-private-water-wells). Regardless of the source of the water, the physiological need for water should be the same among populations using community or private water systems. For the purposes of exposure assessments involving site-specific contaminated drinking water, ingestion rates based on the community supply are most appropriate. Given the assumption that bottled water, and purchased foods and beverages that contain water are widely distributed and less likely to contain source-specific water, the use of total water ingestion rates may overestimate the potential exposure to toxic substances present only in local water supplies; therefore, tap water ingestion of community water, rather than total water ingestion, is emphasized in this section.

The key studies on water ingestion for the general population and pregnant and lactating women (NHANES), and the populations of formula-fed infants (CSFII) are based on short-term survey data (2 days). Although short-term data may be suitable for obtaining mean or median ingestion values that are representative of both short- and long-term ingestion distributions, upper- and lower-percentile values may be different for short-term and long-term data. Note too that most currently available water ingestion surveys are based on respondent recall, which may be a source of uncertainty in the estimated ingestion rates because of the subjective nature of this type of survey technique. Percentile distributions for water ingestion are presented in this handbook, where sufficient data are available. Information on ingestion of water based on climate and activity level, and on incidental ingestion of water while swimming, is also provided in this chapter.

Section 3.2 provides the recommendations and confidence ratings for use in risk assessment for community water ingestion among the general population, formula-fed infants, and pregnant and lactating women, and water ingestion among swimmers. Section 3.3.1 provides the key studies for general population water ingestion rates, Section 3.4.1 provides ingestion rates for pregnant and lactating women, Section 3.5.1 provides ingestion rates for formula-fed infants, Section 3.7 provides ingestion rates for swimmers, and Section 3.8 provides data for other inadvertent water ingestion. For water ingestion at high activity levels or hot climates, no recommendations are provided, but Section 3.6 includes relevant studies on this topic. Relevant studies on all subcategories of water ingestion are also presented to provide the reader with added perspective on the current state of knowledge pertaining to ingestion of water and select liquids.

## 3.2. RECOMMENDATIONS

### 3.2.1. Water Ingestion from Consumption of Water as a Beverage and from Food and Drink

The recommended general population water ingestion rate values for the consumption of water as a beverage (direct) and from foods and drinks (indirect) are based on U.S. EPA's analysis of NHANES data from 2005−2010. Table 3-1 presents a summary of the recommended values for direct and indirect ingestion of community water. Per capita mean and 95$^{th}$ percentile values range from 145 mL/day to 956 mL/day and 565 mL/day to 2,976 mL/day, respectively, depending on the age group. Consumer-only mean and 95$^{th}$ percentile values range from 245 mL/day to 1,419 mL/day and 658 mL/day to 3,407 mL/day, respectively, depending on the age group. Per capita intake rates represent intake that has been averaged over the entire population (including those individuals that reported no intake). In general, per capita intake rates are appropriate for use in exposure assessments for which average daily dose estimates are of interest because they represent both individuals who drank water during the survey period and individuals who may drink water at some time but did not consume it during the survey period. Consumer-only intake rates represent the quantity of water consumed only by individuals who reported water intake during the survey period. Table 3-2 presents a characterization of the overall confidence in the accuracy and appropriateness of the recommendations for drinking water intake for use in risk assessments.

### 3.2.2. Pregnant and Lactating Women

Based upon the results of the U.S. EPA analysis of 2005−2010 NHANES data, per capita mean and 95$^{th}$ percentile values for ingestion of drinking water among pregnant women were 731 mL/day and 2,859 mL/day, respectively. The per capita mean and 95$^{th}$ percentile values for lactating women were 1,075 mL/day and 3,061 mL/day, respectively. Table 3-3 presents a summary of the recommended

values for water ingestion rates. Table 3-4 presents the confidence ratings for these recommendations.

### 3.2.3. Formula-Fed Infants

The recommended values for drinking water ingestion rates for formula-fed infants are based on the results of Kahn et al. (2013). The mean total direct and indirect water intake values are 505, 627, 699, 691, and 591 mL/day for ages <1 month, 1 to <3 months, 3 to <6 months, 6 to <12 months, and 1 to <2 years, respectively. The 95$^{th}$ percentile total direct and indirect water intake values are 858, 1,096, 1,300, 1,350, and 1,254 for ages <1 month, 1 to <3 months, 3 to <6 months, 6 to <12 months, and 1 to <2 years, respectively. Table 3-5 presents a summary of the recommended values for formula-fed infants, and Table 3-6 presents the confidence ratings for the recommended values for formula-fed infants.

### 3.2.4. Water Ingestion While Swimming or Diving

Based on the data from Dufour (2017), mean swimming pool water ingestion rates were 38, 44, 33, and 28 mL/hour for ages 6 to <11, 11 to <16, 16 to <21, and 21+ years, respectively. Upper percentile (95$^{th}$ percentile) swimming pool water ingestion rates were 96, 152, 105, and 92 mL/hour for ages 6 to <11, 11 to <16, 16 to <21, and 21+ years, respectively. Although these estimates were derived from swimming pool experiments, Dufour et al. (2006) noted that swimming behavior of recreational pool swimmers may be similar to freshwater swimmers. Estimates may be different for saltwater swimmers and competitive swimmers. Table 3-7 presents a summary of the recommended values for water ingestion rates while swimming. Table 3-8 presents the confidence ratings for these recommendations. Data on the amount of time spent swimming can be found in Chapter 16 (see Table 16-1) of this handbook.

**Table 3-1. Recommended Values for Drinking Water Ingestion Rates (2-day average community water intake)[a]**

| Age Group | Mean | | 95th Percentile | | Multiple Percentiles |
|---|---|---|---|---|---|
| | mL/day | mL/kg-day | mL/day | mL/kg-day | |
| Per Capita[b] | | | | | |
| Birth to <1 month | 184 | 42 | 851[c] | 200[c] | |
| 1 to <3 months | 145 | 25 | 905[c] | 164[c] | |
| 3 to <6 months | 187 | 27 | 981[c] | 141[c] | |
| 6 to <12 months | 269 | 30 | 988 | 112 | |
| Birth to <1 year | 220 | 29 | 974 | 137 | |
| 1 to <2 years | 146 | 13 | 565 | 51 | |
| 2 to <3 years | 205 | 15 | 778 | 58 | |
| 3 to <6 years | 208 | 11 | 741 | 42 | |
| 6 to <11 years | 294 | 10 | 1,071 | 34 | |
| 11 to <16 years | 315 | 6 | 1,395 | 26 | |
| 16 to <21 years | 436 | 6 | 1,900 | 28 | See Tables 3-9 and 3-13 |
| 21 to <30 years | 781 | 10 | 2,848 | 39 | |
| 30 to <40 years | 902 | 11 | 2,967 | 38 | |
| 40 to <50 years | 880 | 11 | 2,964 | 38 | |
| 50 to <60 years | 956 | 12 | 2,976 | 37 | |
| 60 to <70 years | 941 | 12 | 2,972 | 35 | |
| 70 to <80 years | 772 | 10 | 2,273 | 31 | |
| 80+ years | 784 | 11 | 2,122 | 30 | |
| 21 to <50 years | 858 | 11 | 2,938 | 38 | |
| 50+ years | 902 | 11 | 2,827 | 35 | |
| All ages | 711 | 11 | 2,641 | 37 | |
| Consumers-Only[d] | | | | | |
| Birth to <1 month | 581 | 133 | 938[c] | 224[c] | |
| 1 to <3 months | 785 | 136 | 1,224[c] | 267[c] | |
| 3 to <6 months | 649 | 93 | 1,125[c] | 158[c] | |
| 6 to <12 months | 554 | 62 | 1,104[c] | 133[c] | |
| Birth to <1 year | 595 | 79 | 1,106[c] | 174[c] | |
| 1 to <2 years | 245 | 22 | 658 | 57 | |
| 2 to <3 years | 332 | 24 | 901 | 67 | |
| 3 to <6 years | 338 | 19 | 836 | 45 | |
| 6 to <11 years | 455 | 15 | 1,258 | 41 | |
| 11 to <16 years | 562 | 10 | 1,761 | 31 | |
| 16 to <21 years | 722 | 10 | 2,214 | 31 | See Tables 3-17 and 3-21. |
| 21 to <30 years | 1,183 | 16 | 3,407 | 47 | |
| 30 to <40 years | 1,277 | 16 | 3,278 | 44 | |
| 40 to <50 years | 1,356 | 17 | 3,374 | 43 | |
| 50 to <60 years | 1,419 | 18 | 3,388 | 42 | |
| 60 to <70 years | 1,394 | 17 | 3,187 | 40 | |
| 70 to <80 years | 1,214 | 16 | 2,641 | 37 | |
| 80+ years | 1,087 | 16 | 2,250 | 33 | |
| 21 to <50 years | 1,277 | 16 | 3,353 | 44 | |
| 50+ years | 1,343 | 17 | 3,081 | 40 | |
| All ages | 1,096 | 17 | 2,972 | 44 | |

**Table 3-1. Recommended Values for Drinking Water Ingestion Rates (2-Day Average Community Water Intake)[a] (Continued)**

| Age Group | Mean | | 95th Percentile | | Multiple Percentiles |
|---|---|---|---|---|---|
| | mL/day | mL/kg-day | mL/day | mL/kg-day | |
| | Per Capita[b] | | | | |

[a] Ingestion rates for combined direct and indirect water from community water supply. Estimates are based on the average of 2 days of water consumption reported for each NHANES respondent. If the respondent reported zero consumption on one of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption.

[b] Per capita intake rates are generated by averaging consumer-only intakes over the entire population (including those individuals that reported no intake).

[c] Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: NHIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).

[d] Consumer-only intake represents the quantity of water consumed only by individuals that reported consuming water during the survey period.

FCID = Food Commodity Intake Database.
NCHS = National Center for Health Statistics.
NHIS = National Health Interview Survey.

Source: U.S. EPA analysis of NHANES 2005−2010 data using the FCID Consumption Calculator at http://fcid.foodrisk.org/.

**Table 3-2. Confidence in Recommendations for Drinking Water Ingestion Rates[a]**

| General Assessment Factors | Rationale | Rating |
|---|---|---|
| **Soundness** | | Medium to High |
| *Adequacy of Approach* | The survey methodology and data analysis were adequate. The surveys sampled approximately 25,000 (NHANES) individuals; sample size varied with age. | |
| *Minimal (or defined) Bias* | No physical measurements were taken. The method relied on recent recall of standardized volumes of drinking water containers. | |
| **Applicability and Utility** | | High |
| *Exposure Factor of Interest* | The key studies were directly relevant to water ingestion. | |
| *Representativeness* | The data were demographically representative (based on stratified random sample). Sample sizes for some age groups were limited. | |
| *Currency* | NHANES data were collected between 2005 and 2010. | |
| *Data Collection Period* | Data were collected for 2 nonconsecutive days. However, long-term variability may be small. Use of a short-term average as a chronic ingestion measure can be assumed. | |
| **Clarity and Completeness** | | High |
| *Accessibility* | NHANES data are publicly available. | |
| *Reproducibility* | The methodology was clearly presented; enough information was included to reproduce the results. | |
| *Quality Assurance* | NHANES data collection follow strict QA/QC procedures. The FCID Calculator also underwent QA/QC. | |
| **Variability and Uncertainty** | | High |
| *Variability in Population* | Full distributions were developed. | |
| *Uncertainty* | Except for data collection based on recall, sources of uncertainty were minimal. | |
| **Evaluation and Review** | | Medium |
| *Peer Review* | NHANES surveys received a high level of peer review. The U.S. EPA analysis of NHANES has not been peer reviewed outside the Agency, but the FCID Consumption Calculator, which was used to conduct the analysis, was internally and externally peer reviewed. | |
| *Number and Agreement of Studies* | There was one key study for drinking water ingestion among the general population. Appendix B provides a comparison of the NHANES 2005−2010 and data sets used previously in the *Exposure Factors Handbook: 2011 Edition* (U.S. EPA, 2011) for estimating water ingestion among the general population (NHANES 2003−2006 and CSFII 1994−1996, 1998). | |
| **Overall Rating** | | **Medium to High, Low** for footnote "c" on Table 3-1 |

[a] See Section 1.5.2 in Chapter 1 of the *Exposure Factors Handbook: 2011 Edition* (U.S. EPA, 2011) for a detailed description of the evaluation criteria used in this table.
FCID = Food Commodity Intake Database.
QA/QC = Quality assurance/quality control.

**Table 3-3. Recommended Values for Water Ingestion Rates of Community Water for Pregnant and Lactating Women, and Women of Child-bearing Age (13 to <50 years)[a]**

| Per Capita[b] | | | | |
|---|---|---|---|---|
| | Mean | | 95th Percentile | |
| Group | mL/day | mL/kg-day | mL/day | mL/kg-day |
| Pregnant women | 731 | 9.8 | 2,859 | 37.3 |
| Lactating women | 1,075 | 16.5 | 3,061[c] | 47.0 |
| Child-bearing age | 683 | 9.8 | 2,634 | 38.2 |
| **Consumers-Only[d]** | | | | |
| | Mean | | 95th Percentile | |
| Group | mL/day | mL/kg-day | mL/day | mL/kg-day |
| Pregnant women | 1,158 | 15.5 | 2,935[c] | 37.7 |
| Lactating women | 1,495 | 22.9 | 3,061[c] | 47.0 |
| Child-bearing age | 1,082 | 15.6 | 2,956 | 44.6 |

[a] Ingestion rates for combined direct and indirect water from community water supply. Estimates are based on the average of 2 days of water consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption.

[b] Per capita intake rates are generated by averaging consumer-only intakes over the entire population (including those individuals that reported no intake). See Table 3-62.

[c] Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: NHIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).

[d] Consumer-only intake represents the quantity of water consumed only by individuals that reported consuming water during the survey period. See Table 3-63.

NCHS = National Center for Health Statistics.
NHIS = National Health Interview Survey.

Source: U.S. EPA analysis of NHANES 2005−2010 data using the FCID Consumption Calculator at http://fcid.foodrisk.org/.

**Table 3-4. Confidence in Recommendations for Water Ingestion for Pregnant/Lactating Women[a]**

| General Assessment Factors | Rationale | Rating |
|---|---|---|
| **Soundness** | | Low |
| *Adequacy of Approach* | The survey methodology and data analysis were adequate. The sample size was relatively small: 426 pregnant and 101 lactating women. | |
| *Minimal (or defined) Bias* | No physical measurements were taken. The method relied on recent recall of standardized volumes of drinking water containers. | |
| **Applicability and Utility** | | Low to Medium |
| *Exposure Factor of Interest* | The key study was directly relevant to water ingestion. | |
| *Representativeness* | The data were demographically representative (based on stratified random sample). | |
| *Currency* | Data were collected between 2005 and 2010. | |
| *Data Collection Period* | Data were collected for 2 nonconsecutive days. However, long-term variability may be small. Use of a short-term average as a chronic ingestion measure can be assumed. | |
| **Clarity and Completeness** | | Medium |
| *Accessibility* | The NHANES data are publicly available. | |
| *Reproducibility* | The methodology was clearly presented; enough information was included to reproduce the results. | |
| *Quality Assurance* | NHANES data collection follow strict QA/QC procedures. The FCID Consumption Calculator also underwent QA/QC. | |
| **Variability and Uncertainty** | | Low |
| *Variability in Population* | Full distributions were developed. | |
| *Uncertainty* | Except for data collection based on recall and the relatively small sample size, sources of uncertainty were minimal. | |
| **Evaluation and Review** | | Medium |
| *Peer Review* | NHANES surveys received a high level of peer review. The U.S. EPA analysis of NHANES has not been peer reviewed outside the Agency, but the FCID Consumption Calculator, which was used to conduct the analysis was internally and externally peer reviewed. | |
| *Number and Agreement of Studies* | There was one key study for pregnant/lactating women water ingestion. | |
| **Overall Rating** | | **Low** |

[a] See Section 1.5.2 in Chapter 1 of the *Exposure Factors Handbook: 2011 Edition* (U.S. EPA, 2011) for a detailed description of the evaluation criteria used in this table.

FCID = Food Commodity Intake Database.

QA/QC = Quality assurance/quality control.

**Table 3-5. Recommended Values for Water Ingestion Rates of Community Water for Formula-Fed Infants[a]**

| Indirect in Formula[b] | | | | |
|---|---|---|---|---|
| | Mean | | 95th Percentile | |
| Group | mL/day | mL/kg-day | mL/day | mL/kg-day |
| <1 month | 491[c] | 143[c] | 856[c] | 240[c] |
| 1 to <3 months | 572 | 124 | 963[c] | 285[c] |
| 3 to <6 months | 645 | 93 | 1,112[c] | 171[c] |
| 6 to <12 months | 573 | 65 | 1,192[c] | 136[c] |
| 1 to <2 years | 364 | 38[c] | 745[c] | 82[c] |
| **Total Direct and Indirect[d]** | | | | |
| | Mean | | 95th Percentile | |
| Group | mL/day | mL/kg-day | mL/day | mL/kg-day |
| <1 month | 505[c] | 146[c] | 858[c] | 240[c] |
| 1 to <3 months | 627 | 136 | 1,096[c] | 290[c] |
| 3 to <6 months | 699 | 101 | 1,300[c] | 186[c] |
| 6 to <12 months | 691 | 78 | 1,350[c] | 151[c] |
| 1 to <2 years | 591 | 60 | 1,254[c] | 119[c] |

[a] Formula-consumers only; see Table 3-83.

[b] Water used to reconstitute formula.

[c] The sample size does not meet the minimum reporting requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

[d] Ingestion rates for combined direct and indirect water from community water supply; includes water used to reconstitute formula plus all other community water ingested.

Source: Kahn et al. (2013).

**Table 3-6. Confidence in Recommendations for Water Ingestion for Formula-Fed Infants[a]**

| General Assessment Factors | Rationale | Rating |
|---|---|---|
| **Soundness** | | Medium |
| *Adequacy of Approach* | The survey methodology and data analysis were adequate. Data were available for approximately 700 formula-fed infants overall, but the sample sizes were small for some age ranges. | |
| *Minimal (or defined) Bias* | No physical measurements were taken. The method relied on recent recall of volumes of drinking water used to reconstitute infant formula. | |
| **Applicability and Utility** | | Medium |
| *Exposure Factor of Interest* | The key study was directly relevant to water ingestion. | |
| *Representativeness* | The data were demographically representative (based on stratified random sample). | |
| *Currency* | Data were collected between 1994 and 1998. | |
| *Data Collection Period* | Data were collected for 2 nonconsecutive days. However, long-term variability may be small. Use of a short-term average as a chronic ingestion measure can be assumed. | |
| **Clarity and Completeness** | | Medium |
| *Accessibility* | The CSFII data are publicly available. The Kahn et al. (2013) analysis of the CSFII 1994−1996, 1998 data was published in a peer-reviewed journal. | |
| *Reproducibility* | The methodology was clearly presented; enough information was included to reproduce the results. | |
| *Quality Assurance* | Quality assurance of the CSFII data was good; quality control of the secondary data analysis was not well described. | |
| **Variability and Uncertainty** | | Medium |
| *Variability in Population* | Mean and 95$^{th}$ percentile values were provided for five age groups of infants (Kahn et al., 2013). | |
| *Uncertainty* | Except for data collection based on recall, sources of uncertainty were minimal. | |
| **Evaluation and Review** | | Medium |
| *Peer Review* | The USDA CSFII survey received a high level of peer review. The Kahn et al. (2013) study was published in a peer-reviewed journal. | |
| *Number and Agreement of Studies* | There was one key study for formula-fed infants. | |
| **Overall Rating** | | **Medium** |

[a] See Section 1.5.2 in Chapter 1 of the *Exposure Factors Handbook: 2011 Edition* (U.S. EPA, 2011) for a detailed description of the evaluation criteria used in this table.

**Table 3-7. Recommended Values for Water Ingestion While Swimming**

| Age Group years | Mean | Upper Percentile |
|---|---|---|
| | mL/hour | mL/hour |
| 6 to <11 | 38 | 96 |
| 11 to <16 | 44 | 152 |
| 16 to <21 | 33 | 105 |
| 21+ | 28 | 92 |

Source: Dufour (2017); based on data provided to L. Phillips by A. Dufour by personal communication, 6/21/2017.

**Table 3-8. Confidence in Recommendations for Water Ingestion While Swimming[a]**

| General Assessment Factors | Rationale | Rating |
|---|---|---|
| **Soundness** | | Medium |
| *Adequacy of Approach* | The approach appears to be appropriate given that cyanuric acid (a tracer used in treated pool water) is not metabolized. The Dufour et al. (2006, 2017) studies analyzed primary data on water ingestion during swimming. | |
| *Minimal (or defined) Bias* | Swimmers were asked to swim for approximately 1 hour, but the swimming durations used in calculating the ingestion rates were based on self-reported estimates that may not accurately reflect the actual time spent swimming. | |
| **Applicability and Utility** | | Low to Medium |
| *Exposure Factor of Interest* | The key study was directly relevant to water ingestion while swimming. | |
| *Representativeness* | The sample was not representative of the U.S. population. Data were provided for three broad age ranges (i.e., children, teens, adults). | |
| *Currency* | The pilot study (Dufour et al., 2006) was conducted in 2005 and the full study (Dufour et al., 2017) was conducted after the pilot study. | |
| *Data Collection Period* | Samples were collected after a swimming period of approximately 1 hour. | |
| **Clarity and Completeness** | | Medium |
| *Accessibility* | The Dufour et al. (2006, 2017) studies were published in peer-reviewed journals. Dufour (2017) provided the raw data, which were analyzed to provide additional percentile values for additional age groups. | |
| *Reproducibility* | The methodology was clearly presented; enough information was included to reproduce the results. | |
| *Quality Assurance* | Quality assurance methods were not described in the study. | |
| **Variability and Uncertainty** | | Low |
| *Variability in Population* | Full distributions were not available in the paper, but the data were provided by the author via personal communications (Dufour, 2017). Data were broken out by broad age groups. | |
| *Uncertainty* | The sources of uncertainty were that the sample population may not reflect swimming practices for all swimmers, and the rates were based on self-reported swimming durations. | |
| **Evaluation and Review** | | Medium |
| *Peer Review* | The Dufour et al. (2006, 2017) studies were published in peer-reviewed journals. | |
| *Number and Agreement of Studies* | There were two key studies for ingestion of water when swimming (Dufour et al., 2006, 2017). | |

[a] See Section 1.5.2 in Chapter 1 of the *Exposure Factors Handbook: 2011 Edition* (U.S. EPA, 2011) for a detailed description of the evaluation criteria used in this table.

## 3.3. DRINKING WATER INGESTION STUDIES

### 3.3.1. Key Drinking Water Ingestion Study for the General Population

This section provides a summary of the key study on water ingestion among the general population. This key study is the basis for the recommended water estimates for use in risk assessments involving the general population.

#### 3.3.1.1. *U.S. EPA Analysis of NHANES 2005−2010 Data*

The U.S. EPA used the combined 2005−2006, 2007−2008, and 2009−2010 NHANES data sets to estimate water ingestion rates for the general population. The 2005−2010 data set included information on nearly 25,000 individuals. The U.S. Centers for Disease Control and Prevention surveyed households across the United States and collected food and beverage recall data for 2 nonconsecutive days as part of the NHANES. The first dietary recall interview was conducted in person in a Mobile Examination Center, and the second was collected by telephone 3 to 10 days later on a different day of the week. Each individual in the survey was assigned a sample weight based on his or her demographic data. These weights were taken into account when calculating mean and percentile water ingestion rates from various sources.

The U.S. EPA, Office of Pesticide Programs used NHANES 2005−2010 data to update the Food Commodity Intake Database (FCID) that was developed for earlier analyses of data from the USDA's CSFII (USDA, 2000; U.S. EPA, 2000a, b) and NHANES 2003−2006 (U.S. EPA, 2011). In the FCID, NHANES data on the foods people reported eating were converted to the quantities of agricultural commodities eaten, including water that was added in the preparation of foods and beverages. The updated FCID is available at: http://fcid.foodrisk.org/, along with the FCID Consumption Calculator which was used to develop the estimates provided in this chapter for various age groups of the population. This calculator may also be used to develop estimates for other age groups or population, customized to the users' needs.

U.S. EPA derived mean and percentile estimates of daily average water ingestion for the following age categories: Birth to <1 month, 1 to <3 months, 3 to <6 months, 6 to <12 months, 1 to <2 years of age, 2 to <3 years, 3 to <6 years, 6 to <11 years, 11 to <16 years, 16 to <21 years of age, adults 21 years and older in 10-year increments, and all ages. Intake estimates are also provided for some additional age ranges that may be of use to risk assessors, including ages birth to <2 years, 2 to <16 years, 16 to <70 years, 21 to <50 years, and 50+ years.

Consumer-only and per capita water ingestion estimates were generated for four water source categories: community water, bottled water, other sources, and all sources. Consumer-only intake represents the quantity of water consumed by individuals during the survey period. These data are generated by averaging intake across only the individuals in the survey who reported consumption of water. Per capita intake rates are generated by averaging consumer-only intakes over the entire population (including those individuals that reported no intake). In general, per capita intake rates are appropriate for use in exposure assessments for which average dose estimates are of interest because they represent both individuals who drank water during the survey period and individuals who may drink water at some time but did not consume it during the survey period. "All sources" included water from all supply sources such as community water supply (i.e., tap water), bottled water, other sources, and missing/unknown sources. "Community water" included tap water from a community or municipal water supply. "Other sources" included wells, springs, cisterns, other nonspecified sources, and missing/unknown sources that the survey respondent was unable to identify. The water ingestion estimates for community water, other sources, and all sources included both water ingested directly as a beverage (direct water) and water added to foods and beverages during final preparation at home or by local food service establishments such as school cafeterias and restaurants (indirect water). Bottled water estimates include direct ingestion only. Commercial water added by a manufacturer (i.e., water contained in soda or beer) and intrinsic water in foods and liquids (i.e., milk and natural undiluted juice) were not included in the estimates. NHANES water consumption respondent data were averaged over both days of dietary data. Intake rate distributions were provided in units of mL/day and mL/kg-day. The body weights of survey participants were used in developing intake rate estimates in units of mL/kg-day.

Tables 3-9 to 3-24 present full distributions for the various water source categories (community water, bottled water, other sources, and all sources). Tables 3-9 to 3-12 provide per capita water ingestion estimates in mL/day for the various water source categories (i.e., community, bottled, other, and all sources). Tables 3-13 to 3-16 present the same information as Tables 3-9 to 3-12, but in units of mL/kg-day. Tables 3-17 to 3-20 provide consumers-only water ingestion estimates in mL/day for the various source categories. Tables 3-21 to 3-24

present the same information as Tables 3-17 to 3-20, but in units of mL/kg-day. Estimates that do not meet the minimum sample size as described in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: NHIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993), are flagged in the tables. The design effect used to determine the minimum required sample size was domain specific (i.e., calculated separately for various age groups).

When indexed to body weight, the per capita ingestion rate of water from all sources combined for children under 6 months of age was more than 4 times higher than that of adults ≥21 years (see Table 3-16). Among consumers-only younger than 6 months of age, the ingestion rate for all sources combined was more than 5 times that of adults when indexed to body weight (see Table 3-24). The pattern of decreasing water ingestion per unit of body weight was also observed in per capita and consumers-only estimates of community water (see Tables 3-13 and 3-21), and other sources (see Tables 3-15 and 3-23). However, this trend was not observed in estimates of bottled water.

The advantages of U.S. EPA's analysis of the 2005−2010 NHANES surveys are (1) that the surveys were designed to obtain a statistically valid sample of the civilian noninstitutionalized U.S. population (i.e., the sampling frame was organized using 2000 U.S. population census estimates); (2) several sets of sampling weights were available for use with the intake data to facilitate proper analysis of the data; (3) the sample size was sufficient to allow categorization within narrowly defined age categories, and the large sample provided useful information on the overall distribution of ingestion by the population and should adequately reflect the range among respondent variability; (4) the survey was conducted over 2 nonconsecutive days, which improved the variance over consecutive days of consumption; and (5) the most current FCID data set was used. One limitation of the data is that the data were collected over only 2 days and do not necessarily represent "usual" intake. "Usual dietary intake" refers to the long-term average of daily intakes by an individual. Thus, water ingestion estimates based on short-term data may differ from long-term rates, especially at the tails of the distribution. There are, however, several limitations associated with these data. Water intake estimates for some age groups, particularly at the tails of the distribution, are less statistically reliable due to small sample sizes, as noted in Tables 3-9 to 3-24. In addition, NHANES does not allow for the allocation of indirect water intake in estimating bottled water consumption. Another limitation of these data is that the survey design, while being well tailored for the overall population of the United States and conducted throughout the year to account for seasonal variation, is of limited use for assessing small and potentially at-risk populations based on ethnicity, medical status, geography/climate, or other factors such as activity level.

### 3.3.2. Relevant Drinking Water Ingestion Studies for the General Population

The sections that follow provide summaries of studies on water ingestion among the general population that have been categorized as relevant rather than key. Studies were classified as relevant if they provided supporting water ingestion data (e.g., older studies, studies that provided information on the source of water) or information related to the factor of interest (e.g., physiologic need for water), or the study design or approach makes the data less applicable to the population of interest (e.g., small sample size, limited to certain age groups).

#### 3.3.2.1. *Wolf (1958)—Body Water Content*

Wolf (1958) provided information on the water content of human bodies, stating that a newborn baby is about 77% water while an adult male is about 60% water by weight. An adult male gains and loses about 2,750 mL of water each day. Water intake in dissimilar mammals varies according to 0.88 power of body weight.

#### 3.3.2.2. *National Research Council (1977)—Drinking Water and Health*

NRC (1977) calculated the average per capita water (liquid) consumption per day to be 1.63 L. This figure was based on a survey of the following literature sources: Starling (1941); Bourne and Kidder (1953); Walker et al. (1957); Wolf (1958); Guyton (1968); McNall and Schlegel (1968); Randall (1973); NRC (1974); and Pike and Brown (1975) as cited in NRC (1977). Although the calculated average intake rate was 1.63 L/day, NRC (1977) adopted a larger rate (2 L/day) to represent the intake of the majority of water consumers. This value is relatively consistent with the total tap water intakes rate estimated from the key study presented in this chapter. However, the use of the term "liquid" was not clearly defined in this study, and it is not known whether the populations surveyed are representative of the adult U.S. population. Consequently, the results of this study are of limited use in recommending total tap water intake rates, and this study is not considered a key study.

#### 3.3.2.3. *Pennington (1983)—Revision of the Total Diet Study Food List and Diets*

Based on data from the U.S. Food and Drug Administration's Total Diet Study, Pennington (1983) reported average intake rates for various foods and beverages for five age groups of the population. The Total Diet Study is conducted annually to monitor the nutrient and contaminant content of the U.S. food supply and to evaluate trends in consumption. Representative diets were developed based on 24-hour recall and 2-day diary data from the 1977−1978 USDA Nationwide Food Consumption Survey (NFCS) and 24-hour recall data from the Second National Health and Nutrition Examination Survey (NHANES II). The numbers of participants in NFCS and NHANES II were approximately 30,000 and 20,000, respectively. The diets were developed to "approximate 90% or more of the weight of the foods usually consumed" (Pennington, 1983). The source of water (bottled water as distinguished from tap water) was not stated in the Pennington study. For the purposes of this report, the consumption rates for the food categories defined by Pennington (1983) were used to calculate total fluid and total water intake rates for five age groups. Total water includes water, tea, coffee, soft drinks, and soups and frozen juices that are reconstituted with water. Reconstituted soups were assumed to be composed of 50% water, and juices were assumed to contain 75% water. Total fluids include total water in addition to milk, ready-to-use infant formula, milk-based soups, carbonated soft drinks, alcoholic beverages, and canned fruit juices. Table 3-25 presents these intake rates. Based on the average intake rates for total water for the two adult age groups, 1.04 and 1.26 L/day, the average adult intake rate is about 1.15 L/day. These rates should be more representative of the amount of source-specific water consumed than are total fluid intake rates. This study, which used both USDA 1978 data and NHANES II data, was designed to measure food intake. Consequently, no systematic attempt was necessarily made to define tap water intake per se, as distinguished from bottled water. For this reason, it is not considered a key tap water study in this document.

#### 3.3.2.4. *U.S. EPA (1984)—An Estimation of the Daily Average Food Intake by Age and Sex for Use in Assessing the Radionuclide Intake of the General Population*

Using data collected by USDA in the 1977−1978 NFCS, U.S. EPA (1984) determined daily food and beverage intake levels by age to be used in assessing radionuclide intake through food consumption. Tap water, water-based drinks, and soups were identified subcategories of the total beverage category. Table 3-26 presents daily intake rates for tap water, water-based drinks, soup, and total beverages. As seen in Table 3-26, mean tap water intake for different adult age groups (age 20 years and older) ranged from 0.62 to 0.76 L/day, water-based drinks intake ranged from 0.34 to 0.69 L/day, soup intake ranged from 0.04 to 0.06 L/day, and mean total beverage intake levels ranged from 1.48 to 1.73 L/day. Total tap water intake rates were estimated by combining the average daily intakes of tap water, water-based drinks, and soups for each age group. For adults (ages 20 years and older), mean total tap water intake rates range from 1.04 to 1.47 L/day, and for children (ages <1 to 19 years), mean intake rates range from 0.19 to 0.90 L/day. The total tap water intake rates, derived by combining data on tap water, water-based drinks, and soup should be more representative of source-specific drinking water intake than the total beverage intake rates reported in this study. The chief limitation of the study is that the data were collected in 1978 and do not reflect the expected increase in the U.S. consumption of soft drinks and bottled water or changes in the diet within the last three decades. Because the data were collected for only a 3-day period, the extrapolation to chronic intake is uncertain. Also, these intake rates do not include reconstituted infant formula. For these reasons, this is not considered a key study in this document.

#### 3.3.2.5. *Cantor et al. (1987)—Bladder Cancer, Drinking Water Source, and Tap Water Consumption*

The National Cancer Institute, in a population-based, case control study investigating the possible relationship between bladder cancer and drinking water, interviewed approximately 8,000 adult white individuals, 21 to 84 years of age (2,805 cases and 5,258 controls) in their homes, using a standardized questionnaire (Cantor et al., 1987). The cases and controls resided in one of five metropolitan areas (Atlanta, Detroit, New Orleans, San Francisco, and Seattle) and five states (Connecticut, Iowa, New Jersey, New Mexico, and Utah). The individuals interviewed were asked to recall the level of intake of tap water and other beverages in a typical week during the winter prior to the interview. Total beverage intake was divided into the following two components: (1) beverages derived from tap water and (2) beverages from other sources. Tap water used in cooking foods and in ice cubes was apparently not considered. Participants also supplied information on the primary source of the water consumed (i.e., private well, community supply, bottled water, etc.). The

control population was randomly selected from the general population and frequency matched to the bladder cancer case population in terms of age, sex, and geographic location of residence. The case population consisted of whites only and had no people under the age of 21 years; 57% were over the age of 65 years. The fluid intake rates for the bladder cancer cases were not used because their participation in the study was based on selection factors that could bias the intake estimates for the general population. Based on responses from 5,258 white controls (3,892 males; 1,366 females), average tap water intake rates for a "typical" week were compiled by sex, age group, and geographic region. Table 3-27 lists these rates. The average total fluid intake rate was 2.01 L/day for men, of which 70% (1.4 L/day) was derived from tap water, and 1.72 L/day for women, of which 79% (1.35 L/day) was derived from tap water. Table 3-28 presents frequency distribution data for the 5,228 controls, for which the authors had information on both tap water consumption and cigarette smoking habits. These data follow a lognormal distribution having an average value of 1.30 L/day and an upper 90$^{th}$ percentile value of approximately 2.40 L/day. These values were determined by graphically interpolating the data of Table 3-28 after plotting it on log probability graph paper. These values represent the usual level of intake for this population of adults in the winter. Limitations associated with this data set are that the population surveyed was older than the general population and consisted exclusively of whites. Also, the intake data are based on recall of behavior during the winter only. Extrapolation of the data to other seasons is difficult.

The authors presented data on person-years of residence with various types of water supply sources (municipal vs. private, chlorinated vs. nonchlorinated, and surface vs. well water). Unfortunately, these data cannot be used to draw conclusions about the national average apportionment of surface versus groundwater because a large fraction (24%) of municipal water intake in this survey could not be specifically attributed to either ground or surface water.

#### 3.3.2.6. *Ershow and Cantor (1989)—Total Water and Tap Water Intake in the United States: Population-Based Estimates of Quantities and Sources*

Ershow and Cantor (1989) estimated water intake rates based on data collected by the USDA 1977−1978 NFCS. The survey was conducted through interviews and diary entries. Daily intake rates for tap water and total water were calculated for various age groups for males, females, and both sexes combined. Tap water was defined as "all water from the household tap consumed directly as a beverage or used to prepare foods and beverages." Total water was defined as tap water plus "water intrinsic to foods and beverages" (i.e., water contained in purchased food and beverages). The authors showed that the age, sex, and racial distribution of the surveyed population closely matched the estimated 1977 U.S. population.

Table 3-29 presents daily total tap water intake rates, expressed as mL/day by age group. These data follow a lognormal distribution. Table 3-30 presents the same data, expressed as mL/kg-day. This shows that the mean and 90$^{th}$ percentile intake rates for adults (ages 20 to 65+) are approximately 1,410 mL/day and 2,280 mL/day, and for all ages, the mean and 90$^{th}$ percentile intake rates are 1,193 mL/day and 2,092 mL/day. Note that older adults have greater intakes than do adults between ages 20 and 64, an observation bearing on the interpretation of the Cantor et al. (1987) study, which surveyed a population that was older than the national average (see Section 3.3.2.8).

Ershow and Cantor (1989) also measured total water intake for the same age groups and concluded that it averaged 2,070 mL/day for all groups combined and that tap water intake (1,190 mL/day) is 55% of the total water intake. Table 3-31 presents total tap water intake as a percentage of total water intake for various age groups. Ershow and Cantor (1989) also concluded that, for all age groups combined, the proportion of tap water consumed as drinking water or used to prepare foods and beverages is 54, 10, and 36%, respectively. (Table 3-32 presents the detailed data on the proportion of tap water consumed for various age groups). Ershow and Cantor (1989) also observed that males of all age groups had higher total water and tap water consumption rates than females; the variation of each from the combined-sexes mean was about 8%.

With respect to region of the country, the Northeast had slightly lower average tap water intake (1,200 mL/day) than the three other regions (which were approximately equal at 1,400 mL/day).

This survey has an adequately large size (26,446 individuals), and it is a representative sample of the U.S. population with respect to age distribution and residential location. The data, however, are more than 20 years old and may not be entirely representative of current patterns of water intake.

#### 3.3.2.7. *Roseberry and Burmaster (1992)—Lognormal Distributions for Water Intake*

Roseberry and Burmaster (1992) fit lognormal distributions to the water intake data population-wide distributions for total fluid and total tap water intake based on proportions of the population in each age group. Their publication shows the data and the fitted

lognormal distributions graphically. The mean was estimated as the zero intercept, and the standard deviation (SD) was estimated as the slope of the best-fit line for the natural logarithm of the intake rates plotted against their corresponding *z*-scores (Roseberry and Burmaster, 1992). Least squares techniques were used to estimate the best-fit straight lines for the transformed data. Table 3-33 presents summary statistics for the best-fit lognormal distribution. In this table, the simulated balanced population represents an adjustment to account for the difference in the age distribution of the U.S. population in 1988 from the age distribution in 1978 when Ershow and Cantor (1989) collected their data. Table 3-34 summarizes the quantiles and means of tap water intake as estimated from the best-fit distributions. The mean total tap water intake rates for the two adult populations (ages 20 to 65 years, and 65+ years) were estimated to be 1.27 and 1.34 L/day.

These intake rates were based on the data originally presented by Ershow and Cantor (1989). Consequently, the same advantages and disadvantages associated with the Ershow and Cantor (1989) study apply to this data set.

#### 3.3.2.8. *Levy et al. (1995)—Infant Fluoride Intake from Drinking Water Added to Formula, Beverages, and Food*

Levy et al. (1995) conducted a study to determine fluoride intake by infants through drinking water and other beverages prepared with water and baby foods. The study was longitudinal and covered the ages from birth to 9 months old. A total of 192 mothers, recruited from the postpartum wards of two hospitals in Iowa City, completed mail questionnaires and 3-day beverage and food diaries for their infants at ages 6 weeks, and 3, 6, and 9 months (Levy et al., 1995). The questionnaire addressed feeding habits, water sources and ingestion, and the use of dietary fluoride supplements during the preceding week (Levy et al., 1995). It also collected data on the quantity of water consumed by itself or as an additive to infant formula, other beverages, or foods. In addition, the questionnaire addressed the infants' ingestion of cow's milk, breast milk, ready-to-feed (RTF) infant products (formula, juices, beverages, baby food), and table foods.

Mothers were contacted for any clarifications of missing data and discrepancies (Levy et al., 1995). Levy et al. (1995) assessed nonresponse bias and found no significant differences in the reported number of adults or children in the family, water sources, or family income at 3, 6, or 9 months. Table 3-35 provides the range of water ingestion from water by itself and from addition to selected foods and beverages. The percentage of infants ingesting water by itself increased from 28% at 6 weeks to 66% at 9 months, respectively, and the mean intake increased slightly over this time frame. During this time frame, the largest proportion of the infants' water ingestion (i.e., 36% at 9 months to 48% at 6 months) came from the addition of water to formula. Levy et al. (1995) noted that 32% of the infants at age 6 weeks and 23% of the infants at age 3 months did not receive any water from any of the sources studied. Levy et al. (1995) also noted that the proportion of children ingesting some water from all sources gradually increased with age.

The advantages of this study are that it provides information on water ingestion of infants starting at 6 weeks old, and the data are for water only and for water added to beverages and foods. The limitations of the study are that the sample size was small for each age group, it captured information from a select geographical location, and data were collected through self-reporting. The authors noted, however, that the 3-day diary has been shown to be a valid assessment tool. Levy et al. (1995) also stated that (1) for each time period, the ages of the infants varied by a few days to a few weeks, and are, therefore, not exact and could, at early ages, have an effect on age-specific intake patterns; and (2) the same number of infants were not available at each of the four time periods.

#### 3.3.2.9. *USDA (1995)—Food and Nutrient Intakes by Individuals in the United States, 1 Day, 1989−1991*

USDA (1995) collected data on the quantity of "plain drinking water" and various other beverages consumed by individuals in 1 day during 1989 through 1991. The data were collected as part of USDA's CSFII. The data used to estimate mean per capita intake rates combined 1-day dietary recall data from 3 survey years, 1989, 1990, and 1991, during which 15,128 individuals supplied 1-day intake data. Individuals from all income levels in the 48 conterminous states and Washington D.C. were included in the sample. A complex three-stage sampling design was employed, and the overall response rate for the study was 58%. To minimize the biasing effects of the low response rate and adjust for the seasonality, a series of weighting factors was incorporated into the data analysis. Table 3-36 presents the intake rates based on this study. Table 3-36 includes data for (1) "plain drinking water," which might be assumed to mean tap water directly consumed rather than bottled water; (2) coffee and tea, which might be assumed to be constituted from tap water; (3) fruit drinks and ades, which might

be assumed to be reconstituted from tap water rather than canned products; and (4) the total of the three sources. With these assumptions, the mean per capita total intake of water is estimated to be 1,416 mL/day for adult males (i.e., 20 years of age and older), 1,288 mL/day for adult females (i.e., 20 years of age and older), and 1,150 mL/day for all ages and both sexes combined. Although these assumptions appear reasonable, a close reading of the definitions used by USDA (1995) reveals that the word "tap water" does not occur, and this uncertainty prevents the use of this study as a key study of tap water intake.

The advantages of using these data are that (1) the survey had a large sample size and (2) the authors attempted to represent the general U.S. population by oversampling low-income groups and by weighting the data to compensate for low response rates. The disadvantages are that (1) the word "tap water" was not defined, and the assumptions that must be used to compare the data with the other tap water studies might not be valid; (2) the data collection period reflects only a 1-day intake period and may not reflect long-term drinking water intake patterns; (3) data on the percentiles of the distribution of intakes were not given; and (4) the data are almost 20 years old and may not be entirely representative of current intake patterns.

#### 3.3.2.10. *U.S. EPA (1996)—Descriptive Statistics from a Detailed Analysis of the National Human Activity Pattern Survey (NHAPS) Responses*

The U.S. EPA collected information on the number of glasses of drinking water and juice reconstituted with tap water consumed by the general population as part of the National Human Activity Pattern Survey (NHAPS) (U.S. EPA, 1996). NHAPS was conducted between October 1992 and September 1994. Over 9,000 individuals in the 48 contiguous United States provided data on the duration and frequency of selected activities and the time spent in selected microenvironments via 24-hour diaries. Over 4,000 NHAPS respondents also provided information on the number of 8-ounce glasses of water and the number of 8-ounce glasses of juice reconstituted with water that they drank during the 24-hour survey period (see Tables 3-37 and 3-38). The median number of glasses of tap water consumed was 1−2, and the median number of glasses of juice with tap water consumed was 1−2.

For both individuals who drank tap water and individuals who drank juices reconstituted with tap water, the number of glasses consumed in a day ranged from 1 to 20 glasses. The highest percentage of the population (37.1%) who drank tap water, consumed in the range of 3−5 glasses a day, and the highest percentage of the population (51.5%) who consumed juice reconstituted with tap water consumed 1−2 glasses in a day. Based on the assumption that each glass contained 8 ounces of water (226.4 mL), the total volume of tap water and juice with tap water consumed would range from 0.23 L/day (1 glass) to 4.5 L/day (20 glasses) for respondents who drank tap water. Using the same assumption, the volume of tap water consumed for the population who consumed 3−5 glasses would be 0.68 L/day to 1.13 L/day, and the volume of juice with tap water consumed for the population who consumed 1−2 glasses would be 0.23−0.46 L/day. Assuming the average individual consumes 3−5 glasses of tap water plus 1−2 glasses of juice with tap water, the range of total tap water intake for this individual would range from 0.9 L/day to 1.64 L/day. These values are consistent with the average intake rates observed in other studies.

The advantages of NHAPS are that the data were collected for a large number of individuals and that the data are representative of the U.S. population. However, evaluation of drinking water intake rates was not the primary purpose of the study, and the data do not reflect the total volume of tap water consumed. In addition, using the assumptions described above, the estimated drinking water intake rates from this study are within the same ranges observed for other drinking water studies.

#### 3.3.2.11. *Heller et al. (2000)—Water Consumption and Nursing Characteristics of Infants by Race and Ethnicity*

Heller et al. (2000) analyzed data from the 1994−1996 CSFII to evaluate racial/ethnic differences in the ingestion rates of water in children younger than 2 years old. Using data from 946 children in this age group, the mean amounts of water consumed from eight sources were determined for various racial/ethnic groups, including black non-Hispanic, white non-Hispanic, Hispanic, and "other" (Asian, Pacific Islander, American Indian, Alaskan Native, and other nonspecified racial/ethnic groups). The sources analyzed included (1) plain tap water, (2) milk and milk drinks, (3) reconstituted powdered or liquid infant formula made from drinking water, (4) ready-to-feed and other infant formula, (5) baby food, (6) carbonated beverages, (7) fruit and vegetable juices and other noncarbonated drinks, and (8) other foods and beverages. In addition, Heller et al. (2000) calculated mean plain water and total water ingestion rates for children by age, sex, region, urbanicity, and poverty category. Ages were defined as less than

12 months and 12 to 24 months. Regions were categorized as Northeast, Midwest, South, and West. Heller et al. (2000) did not report the states represented by each of these regions, but it is likely that they defined these regions in the same way Sohn et al. (2001) did. See Section 3.6.1.3 for a discussion on the Sohn et al. (2001) study. Urbanicity of the residence was defined as urban (i.e., being in a metropolitan statistical area [MSA], suburban [outside of an MSA], or rural [being in a non-MSA]). Poverty category was derived from the poverty income ratio. In this study, a poverty income ratio was calculated by dividing the family's annual income by the federal poverty threshold for that size household. The poverty categories used were 0 −1.30, 1.31−3.50, and greater than 3.50 times the federal poverty level (Heller et al., 2000).

Table 3-39 provides water ingestion estimates for the eight water sources evaluated, for each of the race/ethnic groups. Heller et al. (2000) reported that black non-Hispanic children had the highest mean plain tap water intake (21 mL/kg-day), and white non-Hispanic children had the lowest mean plain tap water intake (13 mL/kg-day). The only statistically significant difference between the racial/ethnic groups was found to be in plain tap water consumption and total water consumption. Reconstituted baby formula made up the highest proportion of total water intake for all race/ethnic groups. Table 3-40 presents tap water and total water ingestion by age, sex, region, urbanicity, and poverty category. On average, children younger than 12 months of age consumed less plain tap water (11 mL/kg-day) than children aged 12−24 months (18 mL/kg-day). There were no significant differences in plain tap water consumption by sex, region, or urbanicity. Heller et al. (2000) reported a significant association between higher income and lower plain tap water consumption. For total water consumption, ingestion per kg body weight was lower for the 12- to 24-month-old children than for those younger than 12 months of age. Urban children consumed more plain tap water and total water than suburban and rural children. In addition, plain tap water and total water ingestion was found to decrease with increasing poverty category (i.e., higher wealth).

A major strength of the Heller et al. (2000) study is that it provides information on tap water and total water consumption by race, age, sex, region, urbanicity, and family income. A weakness in the CSFII data set is that is that it includes data collected over only 2 days that may not be entirely representative of long-term intake.

#### 3.3.2.12. *Marshall et al. (2003a)—Patterns of Beverage Consumption during the Transition Stage of Infant Nutrition*

Marshall et al. (2003a) investigated beverage ingestion during the transition stage of infant nutrition. Mean ingestion of infant formula, cow's milk, combined juice and juice drinks, water, and other beverages was estimated using a frequency questionnaire. A total of 701 children, aged 6 months through 24 months, participated in the Iowa Fluoride Study (IFS). Mothers of newborns were recruited from 1992 through 1995. The parents were sent questionnaires when the children were 6, 9, 12, 16, 20, and 24 months old. Of the 701 children, 470 returned all six questionnaires, 162 returned five, 58 returned four, and 11 returned three, with the minimum criteria being three questionnaires to be included in the data set (Marshall et al., 2003a). The questionnaire was designed to assess the type and quantity of the beverages consumed during the previous week. The validity of the questionnaire was assessed using a 3-day food diary for reference (Marshall et al., 2003a). Table 3-41 presents the percentage of subjects consuming beverages and mean daily beverage ingestion for children with returned questionnaires. Human milk ingestion was not quantified, but the percent of children consuming human milk was provided at each age category (see Table 3-41). Juice (100%) and juice drinks were not distinguished separately but categorized as juice and juice drinks. Water used to dilute beverages beyond normal dilution and water consumed alone were combined. Based on Table 3-41, 97% of the children consumed human milk, formula, or cow's milk throughout the study period, and the percentage of infants consuming human milk decreased with age, while the percent consuming water increased (Marshall et al., 2003a). Marshall et al. (2003a) observed that, in general, lower family incomes were associated with less breast-feeding and increased ingestion of other beverages.

The advantage of this study is that it provides mean ingestion data for various beverages. Limitations of the study are that it is based on samples gathered in one geographical area and may not be reflective of the general population. The authors also noted the following limitations: the parents were not asked to differentiate between 100% juice and juice drinks; the data are parent-reported and could reflect perceptions of appropriate ingestion instead of actual ingestion, and a substantial number of the infants from well-educated, economically secure households dropped out during the initial phase.

#### 3.3.2.13. *Marshall et al. (2003b)—Relative Validation of a Beverage Frequency Questionnaire in Children Aged 6 Months through 5 Years Using 3-Day Food and Beverage Diaries*

Marshall et al. (2003b) conducted a study based on data taken from 700 children in the IFS. This study compared estimated beverage ingestion rates reported in questionnaires for the preceding week and diaries for the following week. Packets were sent periodically (every 4 to 6 months) to parents of children aged 6 weeks through 5 years of age. This study analyzed data from children, aged 6 and 12 months, and 2 and 5 years of age. Beverages were categorized as human milk, infant formula, cow's milk, juice and juice drinks, carbonated and rehydration beverages, prepared drinks (from powder), and water. The beverage questionnaire was completed by parents and summarized the average amount of each beverage consumed per day by their children. The data collection for the diaries maintained by parents included 1 weekend day and 2 weekdays and included detailed information about beverages consumed. Table 3-42 presents the mean ingestion rates of all beverages for children aged 6 and 12 months and 3 and 5 years. Marshall et al. (2003b) concluded that estimates of beverage ingestion derived from quantitative questionnaires are similar to those derived from diaries. They found that it is particularly useful to estimate ingestion of beverages consumed frequently using quantitative questionnaires.

The advantage of this study is that the survey was conducted in two different forms (questionnaire and diary) and that diaries for recording beverage ingestion were maintained by parents for 3 days. The main limitation is the lack of information on whether the diaries were populated on consecutive or nonconsecutive days. The IFS survey participants may not be representative of the general population of the United States because participants were primarily white, and from affluent and well-educated families in one geographic region of the country.

#### 3.3.2.14. *Skinner et al. (2004)—Transition in Infants' and Toddlers' Beverage Patterns*

Skinner et al. (2004) investigated the pattern of beverage consumption by infants and children participating in the Feeding Infant and Toddlers Study (FITS) sponsored by Gerber Products Company. The FITS is a cross-sectional study designed to collect and analyze data on feeding practices, food consumption, and usual nutrient intake of U.S. infants and toddlers (Devaney et al., 2004). It included a stratified random sample of 3,022 infants and toddlers between 4 and 24 months of age. Parents or primary caregivers of sampled infants and toddlers completed a single 24-hour dietary recall of all foods and beverages consumed by the child on the previous day by telephone interview. All recalls were completed between March and July 2002. Detailed information on data collection, coding, and analyses related to FITS is provided in Devaney et al. (2004).

Beverages consumed by FITS participants were identified as total milks (i.e., human milk, infant formulas, cow's milk, soy milk, goat's milk), 100% juices, fruit drinks, carbonated beverages, water, and "other" drinks (i.e., tea, cocoa, dry milk mixtures, and electrolyte replacement beverages). There were six age groupings in the FITS study: 4 to 6, 7 to 8, 9 to 11, 12 to 14, 15 to 18, and 19 to 24 months. Skinner et al. (2004) calculated the percentage of children in each age group consuming any amount in a beverage category and the mean amounts consumed. Table 3-43 provides the mean beverage consumption rates in mL/day for the six age categories. Skinner et al. (2004) found that some form of milk beverage was consumed by almost all children at each age; however, total milk ingestion decreased with increasing age. Water consumption also doubled with age, from 163 mL/day in children aged 4 to 6 months old to 337 mL/day in children aged 19 to 24 months old. The percentages of children consuming water increased from 34% at 4 to 6 months of age to 77% at 19 to 24 months of age.

A major strength of the Skinner et al. (2004) study is the large sample size (3,022 children). However, beverage ingestion estimates are based on 1 day of dietary recall data and human milk quantity derived from studies that weighed infants before and after each feeding to determine the quantity of human milk consumed (Devaney et al., 2004); therefore, estimates of total milk ingestion may not be accurate.

#### 3.3.2.15. *Barraj et al. (2009)—Within-Day Drinking Water Consumption Patterns: Results from a Drinking Water Consumption Study*

In 2000/2001, Barraj et al. (2009) conducted a Drinking Water Consumption Survey (DWCS), funded by Bayer Crop Science, to generate data that could be used to assess acute effects of exposures lasting less than 24 hours. The objective of the study was to determine how often and how much water participants ingested during the day. Data for a nationally representative sample of the U.S. population were collected over 7-day periods during both summer (August) and winter (March) months. The study participants were selected from households within Bayer's Home Testing Institute consumer panel, and diaries were delivered to 3,000 randomly

selected households in summer, and 3,650 households in winter. The response rates were 33 and 36%, respectively, for the summer and winter surveys, with 994 households completing the summer survey, and 1,320 households completing the winter survey. After excluding diaries with missing or incorrect data, the final data set represented 4,198 individuals (1,740 in summer) and 2,458 in winter). The vast majority of participants were white (90.2% for summer and winter combined), and males and females above the age of 50 years accounted for the largest portion of participants (34.5%). Teenage males and females accounted for the smallest percentage of participants (6.7%), and children accounted for approximately 13% of the survey population. Each survey participant was asked to complete a diary to provide details about their water consumption patterns over a 7-day period. Using the diary data for a randomly selected day for each survey participant, the average number of drinking occasions per day, the average amount consumed per drinking occasion, and the average amount of water consumed per day was determined for each sex and age group for each season (see Table 3-44).

For all sex and age groups combined, there were slightly more daily drinking occasions reported for summer (mean of 4.4) than winter (mean of 4.1), and the average amount consumed per drinking occasion was slightly higher in the summer (266 mL/event) compared to the winter (248 mL/event). Based on one randomly selected day for each survey participant, mean daily water intake was higher for summer (1,141 mL/day; $N = 1{,}740$) than for winter (1,023 mL/day; $N = 2{,}458$). Based on all survey days and all participants ($N = 27{,}192$ person-days), the mean drinking water intake rate for both seasons combined, was 1,118 mL/day, and the 95$^{th}$ percentile was 2,957 mL/day. The mean and 95$^{th}$ percentile intakes rates were 1,200 and 3,194 mL/day, respectively, for summer ($N = 11{,}318$ person-days), and 1,056 and 2,780 mL/day, respectively, for winter ($N = 15{,}874$ person-days).

This study was based on a large, nationally representative sample of the U.S. population, and provided data by season. Also, it provided information on the amount of water consumed per event within a 24-hour period, and data were provided by sex and age. The limitations of this study are that hourly time increments and 2-ounce amount increments were used in collecting the diary data. These factors may contribute to uncertainties regarding the exact consumption times and the exact amounts consumed.

#### 3.3.2.16. *Zizza et al. (2009)—Total Water Intakes of Community-Living Middle-Old and Oldest-Old Adults*

Zizza et al. (2009) used data from NHANES 1999−2002 to estimate total water intake among older Americans, defined as respondents 65 years of age or older ($N = 2{,}054$). Intake was estimated as g/day and as g/body weight/day. Total water was defined as "the sum of the amount of drinking water consumed and the amount of water consumed from food and beverage sources." The relative contributions of total water intake that was derived from plain drinking water, beverages, and food were also calculated. Total water intake was estimated for three age groups of older survey respondents: young-old (65 to <75 years), middle-old (75 to <85 years), and oldest-old (85+ years). Table 3-45 provides the estimates of total water intake for these three age groups. Zizza et al. (2009) reported that total water intake rates for the middle-old and oldest-old groups were significantly lower than for the young-old group. Plain drinking water accounted for 38.1, 39.4, and 39.5% of total water intake for the young-old, middle-old, and oldest-old age groups respectively. Beverages accounted for 40.8, 38.3, and 36.4% of total water intake and food accounted for 21.1, 22.2, and 24.2% of total water intake for the same three age groups respectively.

This study provides information for a nationally representative population of older Americans. However, the water categories are somewhat different from those used elsewhere in this chapter. For example, plain water category appears to include both tap water and bottled water. Likewise, water from beverages may include both water that is intrinsic to purchased beverages (i.e., widely distributed drinks such as carbonated soft drinks) as well as beverages that are prepared with community tap water.

#### 3.3.2.17. *Sebastian et al. (2011)—Drinking Water Intake in the United States; Rosinger et al. (2016)—Daily Water Intake among U.S. Men and Women, 2009−2012*

Sebastian et al. (2011) investigated "plain water" intake using data from NHANES 2005−2008. "Plain water" was defined as "tap water and noncarbonated bottled water without sweeteners or other additions. [It] does not include water naturally present in or added as an ingredient to other beverages or foods." The study authors observed that plain water accounted for approximately one-third of the total water consumed (i.e., total water was defined as plain water plus water contained in foods and beverages). Approximately 69% of plain water was consumed at home and 31% was consumed away from home.

Sebastian et al. (2011) also found that tap water consumed at home accounted for 46% of the plain water consumed; 16% of plain water was tap water consumed away from home. Bottled water consumed at home accounted for 23% of plain water intake, and bottled water consumed away from home accounted for 16% of plain water intake. Using NHANES 2009−2012, Rosinger et al. (2016) estimated that plain water accounted for 30% of total water intake for mean and 34% of total intake for women.

These studies provide general information about plain and total water intake in the United States. The Sebastian et al. (2011) data are provided in units of cups/day. The Rosinger et al. (2016) study provides data in units of L/day, but for mean total water only, not distributions.

#### 3.3.2.18. *Kahn and Stralka (2009)—Estimated Daily Average per Capita Water Ingestion by Child and Adult Age Categories Based on USDA's 1994−1996 and 1998 Continuing Survey of Food Intakes by Individuals and Supplemental Data, Kahn (2008)*

Kahn and Stralka (2009) analyzed the combined 1994−1996 and 1998 CSFII data sets to examine water ingestion rates of more than 20,000 individuals surveyed, including approximately 10,000 under age 21 and 9,000 under age 11. Previous CSFII analyses conducted using the 1994−1996 data sets were reported in U.S. EPA (2000b). USDA surveyed households in the United States and District of Columbia and collected food and beverage recall data as part of the CSFII (USDA, 1998). Data were collected by an in-home interviewer. The Day 2 interview was conducted 3 to 10 days later and on a different day of the week. Each individual in the survey was assigned a sample weight based on his or her demographic data. These weights were taken into account when calculating mean and percentile water ingestion rates from various sources. Kahn and Stralka (2009) derived mean and percentile estimates of daily average water ingestion for the following age categories: <1 month, 1 to <3 months, 3 to <6 months, 6 to <12 months, 1 to <2 years of age, 2 to <3 years, 3 to <6 years, 6 to <11 years, 11 to <16 years, 16 to <18 years, 18 to <21 years of age, 21 years and older, 65 years and older, and all ages. The increased sample size for children younger than 11 years of age (from 4,339 in the initial 1994−1996 survey to 9,643 children in the combined 1994−1996, 1998 survey) enabled water ingestion estimates to be categorized into the finer age categories recommended by U.S. EPA (2005). Consumer-only and per capita water ingestion estimates were reported in the Kahn and Stralka (2009) study for two water source categories: all sources and community water. "All sources" included water from all supply sources such as community water supply (i.e., tap water), bottled water, other sources, and missing sources. "Community water" included tap water from a community or municipal water supply. Other sources included wells, springs, and cisterns; missing sources represented water sources that the survey respondent was unable to identify. The water ingestion estimates included both water ingested directly as a beverage (direct water) and water added to foods and beverages during final preparation at home or by local food service establishments such as school cafeterias and restaurants (indirect water). Commercial water added by a manufacturer (i.e., water contained in soda or beer) and intrinsic water in foods and liquids (i.e., milk and natural undiluted juice) were not included in the estimates. Kahn and Stralka (2009) only reported the mean and 90$^{th}$ and 95$^{th}$ percentile estimates of per capita and consumers-only ingestion. The full distributions of ingestion estimates were provided by the author (Kahn, 2008). Tables 3-46 to 3-61 present full distributions of direct and indirect water intake for the various water source categories (community water, bottled water, other sources, and all sources). Tables 3-46 to 3-49 provide per capita ingestion estimates of total water (combined direct and indirect water) in mL/day for the various water source categories (i.e., community, bottled, other, and all sources). Tables 3-50 to 3-53 present the same information as Tables 3-46 to 3-49, but in units of mL/kg-day. Tables 3-54 to 3-57 provide consumers-only combined direct and indirect water ingestion estimates in mL/day for the various source categories. Tables 3-58 to 3-61 present the same information as Tables 3-54 to 3-57 but in units of mL/kg-day. Estimates that do not meet the minimum sample size requirements as described in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: NHIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993) are flagged in the tables.

The CSFII 1994−1996, 1998 data have both strengths and limitations in regard to estimating water ingestion. These are discussed in detail in U.S. EPA (2004) and Kahn and Stralka (2009). The principal advantages of this survey are that (1) it was designed to be representative of the U.S. population, including children and low-income groups; (2) sample weights were provided that facilitated proper analysis of the data and accounted for nonresponse; and (3) the number of individuals sampled (more than 20,000) is sufficient to allow categorization within narrowly

defined age categories. Another advantage is that bottled water estimates include both direct and indirect intake, whereas the bottled water estimates using NHANES 2005−2010 data (see Section 3.3.1.1) include only bottled water consumed directly as a beverage; they do not include bottled water used in the preparation of foods. One limitation of this survey is that data were collected for only 2 days. As discussed in Section 3.3.1.1 in regard to U.S. EPA's analysis of NHANES data, short-term data may not accurately reflect long-term intake patterns, especially at the extremes (i.e., tails) of the distribution of water intake. This study is considered relevant because more recent data are available from NHANES 2005−2010.

## 3.4. PREGNANT AND LACTATING WOMEN

### 3.4.1. Key Study on Pregnant and Lactating Women

The section that follows provides a summary of the key study on water ingestion among pregnant and lactating women.

#### 3.4.1.1. *EPA Analysis of Consumption Data from 2005−2010 National Health and Nutrition Examination Survey*

EPA estimated water intake rates for pregnant, lactating, and all women of child-bearing age (13 to <50 years) using data from the NHANES for the years 2005 to 2010 and the FCID Consumption Calculator available at http://fcid.foodrisk.org/, as described in Section 3.3.1.1. NHANES 2005−2010 collected data on dietary recall of food and water consumed over the previous 24-hour period on 2 nonconsecutive days. Two-day data were available for 426 pregnant women, 101 lactating women, and 5,543 women of child-bearing age. In the FCID, NHANES data on the foods people reported eating were converted to the quantities of agricultural commodities eaten, including water that was added in the preparation of foods and beverages. Two-day average intake rates were calculated for each survey respondent for community water, bottled water, other water, and all water sources. Summary statistics were calculated for the populations of pregnant, lactating, and females of child-bearing age (i.e., 13 to <50 years) on both a consumer-only and on a per capita basis. Table 3-62 provides summary statistics for per capita intake of water, and Table 3-63 provides the same data on a consumer-only basis.

As indicated in Section 3.3.1.1, an advantage of using the EPA's analysis of NHANES data is it was designed to be representative of the U.S. population. The data set used in this analysis used 6 years of intake data combined. However, the sample sizes for pregnant and lactating women were relatively small and short-term dietary data may not accurately reflect long-term eating or drinking patterns and may under-represent infrequent consumers of a given food. This is particularly true for the tails (extremes) of the food-intake distribution.

### 3.4.2. Relevant Studies on Pregnant and Lactating Women

The sections that follow provide summaries of relevant studies on water ingestion among pregnant and lactating women.

#### 3.4.2.1. *Ershow et al. (1991)—Intake of Tap Water and Total Water by Pregnant and Lactating Women*

Ershow et al. (1991) used data from the 1977−1978 USDA NFCS to estimate total fluid and total tap water intake among pregnant and lactating women (ages 15−49 years). Data for 188 pregnant women, 77 lactating women, and 6,201 nonpregnant, nonlactating control women were evaluated. The participants were interviewed based on 24-hour recall and then asked to record a food diary for the next 2 days. "Tap water" included tap water consumed directly as a beverage and tap water used to prepare food and tap water-based beverages. "Total water" was defined as all water from tap water and nontap water sources, including water contained in food. Tables 3-64 and 3-65 present estimated total fluid and total tap water intake rates for the three groups, respectively. Lactating women had the highest mean total fluid intake rate (2.24 L/day) compared with both pregnant women (2.08 L/day) and control women (1.94 L/day). Lactating women also had a higher mean total tap water intake rate (1.31 L/day) than pregnant women (1.19 L/day) and control women (1.16 L/day). The tap water distributions are neither normal nor lognormal, but lactating women had a higher mean tap water intake than controls and pregnant women. Ershow et al. (1991) also reported that rural women ($N$ = 1,885) consumed more total water (1.99 L/day) and tap water (1.24 L/day) than urban/suburban women ($N$ = 4,581, 1.93 and 1.13 L/day, respectively). Total water and tap water intake rates were lowest in the northeastern region of the United States (1.82 and 1.03 L/day) and highest in the western region of the United States (2.06 L/day and 1.21 L/day). Mean intake per unit body weight was highest among lactating women for both total fluid and total tap water intake. Total tap water intake accounted for over 50% of mean total fluid in all three groups of women (see Table 3-65). Drinking water accounted for the largest single proportion of the total fluid intake for

control (30%), pregnant (34%), and lactating women (30%) (see Table 3-66). All other beverages combined accounted for approximately 46, 43, and 45% of the total water intake for control, pregnant, and lactating women, respectively. Food accounted for the remaining portion of total water intake.

The same advantages and limitations associated with the Ershow and Cantor (1989) data also apply to these data sets (see Section 3.3.2.6). A further advantage of this study is that it provides information on estimates of total water and tap water intake rates for pregnant and lactating women. This topic has rarely been addressed in the literature.

#### 3.4.2.2. *Shimokura et al. (1998)—Assessment of Water Use for Estimating Exposure to Tap Water Contaminants*

Shimokura et al. (1998) evaluated water use among 34 pregnant women and 33 of their male partners living in North Carolina. The women were up to 30 weeks pregnant at the time that the survey was conducted. Most of the women were in their twenties and thirties, were expecting their first child, and were in their second trimester of pregnancy. Approximately three quarters of the women were white and the remainder were of African American and Asian. ethnicities They tended to be highly educated and nonsmokers. Each of the participants completed a daily diary for 3 days, including one nonworking or weekend day, and an interview about their daily water consumption. Information was collected on the volume of all beverages consumed, which was defined as total water, and the volume of drinking water and beverages made with tap water, which was defined as tap water. The temperature of the beverage (i.e., cold or hot), as well as the location where the beverage was consumed, was also recorded. Table 3-67 provides summary statistics for the participants' daily water intake. Daily consumption of total water and tap water were similar for pregnant women and men, but differences based on employment status were observed for daily intake of cold tap water at home. Table 3-68 provides mean intake rates for pregnant women and men according to location, beverage type, and temperature.

This study provides useful information on daily tap water intake for pregnant women. However, the definition of total water differs from that used elsewhere in this chapter (i.e., the water content of foods is not included). Also, the study population is relatively small and may not be entirely representative of the U.S. population.

#### 3.4.2.3. *Zender et al. (2001)—Exposure to Tap Water during Pregnancy*

Zender et al. (2001) conducted a study in Colorado in 1996 and 1997 to compare tap water intake among pregnant and nonpregnant women. A total of 71 pregnant and 43 nonpregnant women were recruited from Women, Infant, and Children (WIC) clinics. Nearly one-half of the pregnant women were in their second trimester, and one-quarter were in each of the first and third trimesters. Approximately one-half of the women worked outside the home, and nearly all the women had a municipal water source at their home. The women were interviewed in person or by phone and responded to questions about the amount of tap water intake in a day—including the amount consumed at home and at work. Total tap water intake included tap water consumed directly as a beverage and tap water-based cold and hot beverages. Information on the sources of the water consumed (e.g., tap water, bottled water, or filtered water) were also collected. Total tap water intake was slightly higher for pregnant women (3.4 L/day) than nonpregnant women (3.0 L/day) (see Table 3-69). Table 3-70 shows the principal source of drinking water for pregnant and for nonpregnant women. Tap water accounted for 72−75% of total water intake.

The advantage of this study is that it investigated tap water consumption based on location (i.e., at home and at work) and by source (i.e., bottled, filtered, or tap water). However, the sample size was small and the study population may not be representative of the entire United States.

#### 3.4.2.4. *Forssén et al. (2007)—Predictors of Use and Consumption of Public Drinking Water among Pregnant Women; Forssén et al. (2009)—Variability and Predictors of Changes in Water Use during Pregnancy*

Forssén et al. (2007) evaluated the demographic and behavioral characteristics that would be important in predicting water consumption among pregnant women in the United States. Data were collected through telephone interviews with 2,297 pregnant women in three geographical areas in the southern United States. Women 18 years old and ≤12 weeks pregnant were recruited from the local communities and from both private and public prenatal care facilities. Variables studied included demographic characteristics, health status and history (e.g., diabetes, pregnancy history), behavioral patterns (e.g., exercise, smoking, caffeine consumption), and some physiological characteristics (e.g., prepregnancy weight). Daily amount of water ingestion was estimated based on cup sizes defined in the interview.

Water consumption was reported as cold tap water (filtered and unfiltered) and bottled water. Other behavioral information on water use such as showering and bathing habits, use of swimming pools, hot tubs, and Jacuzzis was also collected. The overall mean cold tap water ingested was 1.7 L/day (percentiles: $25^{th}$ = 0.5 L/day, $50^{th}$ = 1.4 L/day, $75^{th}$ = 2.4 L/day, and $90^{th}$ = 3.8 L/day). The overall mean bottled water ingested was 0.6 L/day (percentiles: $25^{th}$ = 0.1 L/day, $50^{th}$ = 0.2 L/day, $75^{th}$ = 0.6 L/day, and $90^{th}$ = 1.8 L/day). Table 3-71 presents water ingestion by the different variables studied, and Table 3-72 presents the percentage of ingested tap water that is filtered and unfiltered by various variables.

Forssén et al. (2009) studied changes in water use over the course of pregnancy based on data for 1,990 women that were still pregnant during a second interview. Mean cold tap water intake increased from prepregnancy (1.5 L/day) though early pregnancy (1.7 L/day) to mid-pregnancy (1.8 L/day) (see Table 3-73). Mean hot tap water intake decreased slightly from prepregnancy (0.18 L/day) to early and mid-pregnancy (0.16 L/day). Bottled water intake was essentially the same during early and mid-pregnancy (0.57 and 0.59 L/day, respectively). The greatest changes in water consumption were reported for cold tap water where 80% of the women reported either increases or decreases in consumption; 33% reported changes (increases or decreases) equal to or greater than 1.0 L/day (see Table 3-74).

The advantage of these studies is that they investigated water consumption in relation to multiple variables, and over the course of pregnancy. However, the study population was not random and may not be representative of the entire United States. There may also be limitations associated with recall bias.

#### 3.4.2.5. *Kahn and Stralka (2008)—Estimates of Water Ingestion for Women in Pregnant, Lactating, and Nonpregnant and Nonlactating Child-Bearing Age Groups Based on USDA's 1994−1996, 1998 CSFII*

The combined 1994−1996 and 1998 CSFII data sets were analyzed to examine the ingestion of water by various segments of the U.S. population as described in Section 3.3.1.1. Kahn and Stralka (2008) provided water intake data for pregnant, lactating, and child-bearing age women. Mean and upper percentile distribution data were provided. Lactating women had an estimated per capita mean community water ingestion of 1.38 L/day, the highest water ingestion rates of any among the population evaluated. The mean consumer-only rate was 1.67 L/day. Tables 3-75 through 3-82 provide estimated drinking water intakes for pregnant and lactating women, and nonpregnant, nonlactating women aged 15−44 years old. The same advantages and limitations discussed in Section 3.3.1.1 apply to these data. An additional limitation of this analysis is that the sample size was relatively small (i.e., 70 pregnant and 41 lactating women). This study is considered relevant, but not key because more recent data are available for pregnant and lactating women.

## 3.5. FORMULA-FED INFANTS

### 3.5.1. Key Study on Formula-Fed Infants

The section that follows provides a summary of the key study on water ingestion among formula-fed infants.

#### 3.5.1.1. *Kahn et al. (2013)—Estimates of Water Ingestion in Formula by Infants and Children Based on USDA's 1994−1996 and 1998 Continuing Survey of Food Intakes by Individuals*

Kahn et al. (2013) used data from the 1994−1996 and 1998 CSFII to estimate water ingestion among formula-fed infants, ages <1 month, 1 to <3 months, 3 to <6 months, 6 to <12 months, and 1 to <2 years. The same methodology was used as in Kahn and Stralka (2009), as described in Section 3.3.2.18. Indirect water ingestion among "formula-consumers only" was based on the estimated amount of community water used to reconstitute or dilute infant formula. Total indirect and direct water intake among formula-fed infants represented both water used to reconstitute or dilute baby formula and water consumed directly as a beverage. Mean and $95^{th}$ percentile indirect, and total indirect and direct water ingestion rates for formula-consuming infants are provided in Table 3-83. On a mL/day basis, mean intake rates increased between <1 month and 3 to <6 months and then declined; on a mL/kg-day basis, mean intake declined from <1 month to 1 to <2 years.

The same advantages and disadvantages discussed in Section 3.3.2.18 apply to these data. In addition, as suggested by Kahn et al. (2013), while the more recent data may be available (e.g., NHANES) for this type of analysis, the amount of water ingested by formula-fed infants would not be expected to change significantly because the nutritional needs of infants would not be expected to have varied over time.

### 3.5.2. Relevant Studies on Formula-Fed Infants

The section that follows provides summaries of the relevant studies on water ingestion among formula-fed infants. Sections 3.3.2.8 (Levy et al., 1995), 3.3.2.11

(Heller et al., 2000), and 3.3.2.12 (Marshall et al., 2003a) also provide some relevant information on ingestion of water used in reconstituting infant formula.

#### 3.5.2.1. *Hilbig et al. (2002)—Measured Consumption of Tap Water in German Infants and Young Children as Background for Potential Health Risk Assessment: Data of the DONALD Study*

Hilbig et al. (2002) estimated tap water ingestion rates based on 3-day dietary records of 504 German children aged 3, 6, 9, 12, 18, 24, and 36 months. The data were collected between 1990 and 1998 as part of the Dortmund Nutritional and Anthropometric Longitudinally Designed (DONALD) study. The DONALD study was a cohort study that collected data on diet, metabolism, growth, and development from healthy subjects between infancy and adulthood (Sichert-Hellert et al., 2001). Beginning in 1985, approximately 40 to 50 infants were enrolled in the study annually. Mothers of the participants were recruited in hospital maternity wards. Tap water ingestion rates were calculated for three subgroups of children: (1) breast-fed infants ≤12 months of age (exclusive and partial breast-fed infants), (2) formula-fed infants ≤12 months of age (no human milk, but including weaning food), and (3) mixed-fed young children aged 18 to 36 months. Hilbig et al. (2002) defined "total tap water from household" as water from the tap consumed as a beverage or used in food preparation. "Tap water from food manufacturing" was defined as water used in industrial production of foods, and "Total Tap Water" was defined as tap water consumed from both the household and that used in manufacturing.

Table 3-84 summarizes total tap water ingestion (in mL/day and mL/kg-day) and tap water ingestion from household and manufacturing sources (in mL/kg-day) for breast-fed, formula-fed, and mixed-fed children. Mean total tap water intake during the 1st year of life was higher in formula-fed infants (53 mL/kg-day) than in breast-fed infants (17 mL/kg-day) and mixed-fed young children (19 mL/kg-day). Tap water from household sources constituted 66 to 97% of total tap water ingestion in the different age groups.

The major limitation of this study is that the study sample consists of families from an upper social background in Germany (Hilbig et al., 2002). Because the study was conducted in Germany, the data may not be directly applicable to the U.S. population. However, this study was included in this chapter because similar data for a U.S. population of infants are limited.

#### 3.5.2.2. *Levallois et al. (2008)—Drinking Water Intake by Infants Living in Rural Quebec (Canada)*

Levallois et al. (2008) conducted a survey on a population of 2-month-old infants residing in seven agricultural areas of Canada. Eligible newborns were born in this rural area of Quebec between January and April 2002. Infants who were less than 34 weeks of gestation at birth, families who did not speak French, or those served by surface water supplies were excluded from the study. Families who were eligible for participation were sent a letter explaining the survey followed by a phone interview with the infant's mother. There were 642 mothers who participated in the survey, which was conducted when the infants were 8−9 weeks old. Questions asked during the phone interview included those on feeding practices such as the quantity and number of feedings each day and the specific type and volume of water used for preparing formula, juices, or cereals. Of the 642 participating infants, 38.3% were exclusively breast-fed and, therefore, had no drinking water intake. Almost half of the participating infants (47.5%) were fed either ready-to-use formula or dry formula mixed with water, and 14.2% received mixed breast and formula feedings. Infants who consumed some water comprised 61.2% of the participants, and among these 59, 34, and 7% consumed mostly tap water, bottled water, or both tap and bottled water, respectively. For consumers, mean tap water intake was 564 mL/day (105 mL/kg-day) and mean bottled water intake was 504 mL/day (94 mL/kg/day) (see Table 3-85).

This study provides quantitative estimates of drinking water consumption by a population of 2-month-old infants according to their feeding practices. Limitations of the study include the fact that drinking water intake was not measured, but was provided by the infants' mothers during telephone interviews. Although the participants resided in rural areas of Canada, which may not be entirely representative of the U.S. population, it is assumed that drinking water intake for formula-fed infants would be similar to that of those in the United States. Therefore, Levallois et al. (2008) was included here as a relevant study.

#### 3.5.2.3. *Schier et al. (2010)—Perchlorate Exposure from Infant Formula and Comparisons with the Perchlorate Reference Dose*

Schier et al. (2010) estimated perchlorate exposures among 1- and 6-month-old infants consuming reconstituted powdered infant formula,

using measured concentrations of perchlorate in the formula and estimated formula intake rates. Infant formula ingestion rates were estimated as the product of average infant energy intakes in kcal/kg-day and estimated infant body weights, divided by the estimated number of calories in the infant formula in kcal/L formula. The estimated 50$^{th}$ percentile formula intake rate was estimated to be 0.7 L/day for 1-month-old infants and 1.0 L/day for 6-month-old infants. The estimated 90$^{th}$ percentile formula intake rate was estimated to be 1.0 L/day for 1-month-old infants and 1.4 L/day for 6-month-old infants. This study provides an indirect estimate of water intake among formula-fed infants.

## 3.6. HIGH ACTIVITY LEVELS/HOT CLIMATES

### 3.6.1. Relevant Studies on High Activity Levels/Hot Climates

The following sections provide summaries of relevant studies on water ingestion associated with various activity levels and climates.

#### 3.6.1.1. *McNall and Schlegel (1968)—Practical Thermal Environmental Limits for Young Adult Males Working in Hot, Humid Environments*

McNall and Schlegel (1968) conducted a study that evaluated the physiological tolerance of adult males working under varying degrees of physical activity. Subjects were required to operate pedal-driven propeller fans for 8-hour work cycles under varying environmental conditions. The activity pattern for each individual was cycled as 15 minutes of pedaling and 15 minutes of rest for each 8-hour period. Two groups of eight subjects each were used. Work rates were divided into three categories as follows: high activity level (0.15 horsepower [hp] per person), medium activity level (0.1 hp per person), and low activity level (0.05 hp per person). Evidence of physical stress (i.e., increased body temperature, blood pressure, etc.) was recorded, and individuals were eliminated from further testing if certain stress criteria were met. The amount of water consumed by the test subjects during the work cycles was also recorded. Water was provided to the individuals on request.

Table 3-86 presents the water intake rates obtained at the three different activity levels and the various environmental temperatures. The data presented are for test subjects with continuous data only (i.e., those test subjects who were not eliminated at any stage of the study due to stress conditions). Water intake was the highest at all activity levels when environmental temperatures were increased. The highest intake rate was observed at the low activity level at 100°F (0.65 L/hour); however, there were no data for higher activity levels at 100°F. It should be noted that this study estimated intake on an hourly basis during various levels of physical activity. These hourly intake rates cannot be converted to daily intake rates by multiplying by 24 hours/day because they are only representative of intake during the specified activity levels, and the intake rates for the rest of the day are not known. Therefore, comparison of intake rate values from this study cannot be made with values from the previously described studies on drinking water intake.

#### 3.6.1.2. *U.S. Army (1983, 1999)—Water Consumption Planning Factors*

The U.S. Army has developed water consumption planning factors to enable it to transport an adequate amount of water to soldiers in the field under various conditions (U.S. Army, 1983, 1999). Both climate and activity levels were used to determine the appropriate water consumption needs. Consumption factors have been established for the following uses: (1) drinking, (2) heat treatment, (3) personal hygiene, (4) centralized hygiene, (5) food preparation and sanitation, (6) laundry, (7) medical treatment, (8) vehicle and aircraft maintenance, (9) graves registration, and (10) construction. Only personal drinking water consumption factors are described here. Drinking water consumption planning factors are based on the estimated amount of water needed to replace fluids lost by urination, perspiration, and respiration. It assumes that water lost to urinary output averages 1 quart/day (0.9 L/day), and perspiration losses range from almost nothing in a controlled environment to 1.5 quarts/day (1.4 L/day) in a very hot climate where individuals are performing strenuous work. Water losses to respiration are typically very low except in extreme cold where water losses can range from 1 to 3 quarts/day (0.9 to 2.8 L/day). This occurs when the humidity of inhaled air is near zero, but expired air is 98% saturated at body temperature (U.S. Army, 1983).

Drinking water is defined by the U.S. Army (1983, 1999) as "all fluids consumed by individuals to satisfy body needs for internal water." This includes soups, hot and cold drinks, and tap water. Planning factors have been established for hot, temperate, and cold climates based on the following mixture of activities among the workforce: 15% of the force performing light work, 65% of the force performing medium work, and 20% of the force performing heavy work. Hot climates are defined as tropical and arid areas where the temperature is greater than 80°F. Temperate

climates are defined as areas where the mean daily temperature ranges from 32 to 80°F. Cold regions are areas where the mean daily temperature is less than 32°F. Table 3-87 presents drinking water consumption factors for these three climates. These factors are based on research on individuals and small unit training exercises. The estimates are assumed to be conservative because they are rounded up to account for the subjective nature of the activity mix and minor water losses that are not considered (U.S. Army, 1983, 1999).

The advantage of using these data is that they provide conservative estimates of drinking water intake among individuals performing at various levels of physical activity in hot, temperate, and cold climates. However, the planning factors described here are based on assumptions about water loss from urination, perspiration, and respiration, and are not based on survey data or actual measurements.

#### 3.6.1.3. *Sohn et al. (2001)—Fluid Consumption Related to Climate among Children in the United States*

Sohn et al. (2001) investigated the relationship between fluid consumption among children aged 1 to 10 years and local climate using data from the NHANES III (1988−1994). Children who completed the 24-hour dietary interview (or proxy interview for the younger children) during the NHANES III survey were selected for the analysis. Breast-fed children were excluded from the analysis. Among 8,613 children who were surveyed, 688 (18%) were excluded due to incomplete data. A total of 7,925 eligible children remained. Because data for climatic conditions were not collected in the NHANES III survey, the mean daily maximum temperature from 1961 to 1990, averaged for the month during which the NHANES III survey was conducted, was obtained for each survey location from the U.S. Local Climate Historical Database. Of the 7,925 eligible children with complete dietary data, temperature information was derived for only 3,869 children (48.8%) because detailed information on survey location, in terms of county and state, was released only for counties with a population of more than a half million.

Sohn et al. (2001) calculated the total amount of fluid intake for each child by adding the fluid intake from plain drinking water and the fluid intake from foods and beverages other than plain drinking water provided by NHANES III. Sohn et al. (2001) identified major fluid sources as milk (and milk drinks), juice (fruit and vegetable juices and other noncarbonated drinks), carbonated drinks, and plain water. Fluid intake from sources other than these major sources was grouped into other foods and beverages. Other foods and beverages included bottled water, coffee, tea, baby food, soup, water-based beverages, and water used for diluting food.

Table 3-88 presents mean fluid ingestion rates of selected fluids for the total sample population and for the subsets of the sample population with and without temperature information. The estimated mean total fluid and plain water ingestion rates for the 3,869 children for whom temperature information was obtained are presented in Table 3-89 according to age (years), sex, race/ethnicity, poverty:income ratio, region, and urbanicity. Poverty:income ratio was defined as the ratio of the reported family income to the federal poverty level. The following categories were assigned: low socioeconomic status (SES) = 0.000 to 1.300 times the poverty:income ratio; medium SES = 1.301 to 3.500 times the poverty/income level; and high SES = 3.501 or greater times the poverty/income level. Regions were Northeast, Midwest, South, and West, as defined by the U.S. Census Bureau (see Table 3-89). Sohn et al. (2001) did not find a significant association between mean daily maximum temperature and total fluid or plain water ingestion, either before or after controlling for sex, age, SES, and race or ethnicity. However, significant associations between fluid ingestion and age, sex, socioeconomic status, and race and ethnicity were reported.

The main strength of the Sohn et al. (2001) study is the evaluation of water intake as it relates to weather data. The main limitations of this study were that northeastern and western regions were over-represented because temperature data were only available for counties with populations over one-half million. In addition, whites were under-represented compared to other racial or ethnic groups. Other limitations include lack of data for children from extremely cold or hot weather conditions.

#### 3.6.1.4. *Kant et al. (2009)—Intakes of Plain Water, Moisture in Foods and Beverages, and Total Water in the Adult U.S. Population—Nutritional, Meal Pattern, and Body Weight Correlates: NHANES 1999−2006; Kant and Graubard (2010)—Contributors of Water Intake in U.S. Children and Adolescents: Associations with Dietary and Meal Characteristics—National Health and Nutrition Examination Survey 2005−2006*

Using data from NHANES 1999-2004, Kant et al. (2009) estimated water intake for adults, ages ≥20 years ($N$ = 4,112), based on their reported activity

levels. Intake was for plain water (i.e., including tap water, water from a cooler or drinking fountain, spring water, and noncarbonated bottled water), water in beverages and food, and total water (i.e., the sum of plain water and moisture in beverages and food). Beverages included "all types of liquid milk, shakes, fruit or vegetable juices, juice drinks, carbonated and noncarbonated sweetened or unsweetened drinks, coffee, tea, hot chocolate, all alcoholic drinks, and carbonated water." Multiple linear regression was used to compute adjusted mean water intake based on covariates such as sex, age, race/ethnicity, body mass index, income, education, smoking status, chronic illness, survey wave, survey day, and leisure-time physical activity. Leisure-time physical activity was categorized as having any leisure-time activity lasting ≥10 minutes over the previous month, and according to the average activity level on a given day (i.e., mostly sitting, mostly standing, carry light loads or climb hills, or heavy work or carry heavy loads). Table 3-90 provides a summary of water intake for adults according to these activity categories. Higher intake rates of plain and total water were associated with participation in any leisure-time activity. Higher intake of moisture from beverages and total water were associated with higher average activity levels on a usual day (see Table 3-90).

Kant and Graubard (2010) used a similar approach with data from NHANES 2005−2006 to estimate water intake for children ages 2−19 years of age ($N$ = 3,978). However, the activity level definitions differed from those used for adults in Kant and Graubard (2009). Kant and Graubard (2010) classified activity levels for 2- to 11-year-old children based on the number of times per week the child was reported to have played or exercised hard enough to induce sweat. The categories were: 0 times = none, 1−2 = a little, 3−4 = some, and ≥5 = a lot. For children 12−19 years of age, activity levels were based on three questions about whether participants had any leisure-time activity lasting ≥10 minutes. The three questions pertained to vigorous, moderate, or muscle strengthening activities. The categories were no to all three questions = none, yes to 1 question = a little, yes to 2 questions = some, and yes to all three questions = a lot. Table 3-90 provides water intake estimates based on these activity levels. Kant and Graubard noted that the physical activity level was only weakly associated with plain water intake, but not with the moisture content of beverages or foods, or with total water.

These studies provide information on water intake based on physical activity. However, the water categories are somewhat different from those used elsewhere in this chapter. For example, plain water category appears to include both tap water and bottled water. Likewise, beverage moisture may include both water that is intrinsic to purchased drinks (i.e., widely distributed beverages such as carbonated soft drinks) as well as beverages that may be prepared with community tap water (e.g., coffee).

#### 3.6.1.5. *Yang and Chun (2014)—Consumptions of Plain Water, Moisture in Foods and Beverages, and Total Water in Relation to Dietary Micronutrient Intakes and Serum Nutrient Profiles among U.S. Adults*

Yang and Chun (2014) conducted a study similar to Kant et al. (2009). They estimated water intake among adults, ages 20 years of age and older, based on activity levels. NHANES 2005−2006 data were used to estimate intake of plain water, water from beverages and food, and total water. The definitions of these water categories were the same as those in Kant et al. (2009), but the levels of physical activity were defined differently. Yang and Chun (2014) based the activity levels on "the metabolic equivalent (MET) score calculated by combining the intensity level of the leisure-time activities reported, mean duration and frequency." Water intake was evaluated for four activity levels: no activity (0) and three tertiles of the MET score (T1, T2, and T3). The mean daily total water intake for adults was 3,066 g (see Table 3-90). Yang and Chun (2014) reported that the contributions to total water were 46% from beverages, 32% from plain water, and 22% from food, and higher activity was associated with higher total water intake.

Like the Kant et al. (2009) study, this study provides information on total water intake based on activity levels. However, the water categories differ from those used elsewhere in this chapter.

#### 3.6.1.6. *Montain and Ely (2010)—Water Requirements and Soldier Hydration*

Montain and Ely (2010) provided an overview of factors that affect soldiers' hydration and water balance, including environment, physical activity and load, and body size and gender. For example, increasing temperature and relative humidity increase sweating and the need for water replacement. The type of clothing worn and the load being carried can also affect the rate of perspiration and need for water replacement. Factors affecting water needs in cold climates include: cold-induced diuresis (increased urine loss), respiratory water loss from breathing cold dry air, clothing insulation that induces sweating, and the metabolic cost of movement in cold terrain. High altitude hypoxia can also contribute to water loss. Because sweat losses are dependent on exercise

intensity and duration, water needs increase as energy expenditure increases (Montain and Ely, 2010). Energy expenditure and the need for water replacement also increases with carrying increasingly heavy loads. Montain and Ely (2010) suggested that activity-related caloric costs increase with increasing body size; thus, larger individuals may require larger amounts of water. Likewise, men may require more water than women because they "are heavier and sweat more profusely than women." Montain and Ely (2010) stated that "an individual soldier's daily water requirements to sustain hydration can range from 2 L/day to an excess of 12 L/day, depending on weather conditions, physical activity, and physical size.

This report provides useful information on the factors influencing water losses during military operations. The values presented here are consistent with the recommended planning factors summarized in U.S. Army (1983, 1999) and Section 3.6.1.2.

## 3.7. WATER INGESTION WHILE SWIMMING AND DIVING

### 3.7.1. Key Studies on Water Ingestion While Swimming

The section that follows provides a summary of the key study on water ingestion that may occur while swimming.

#### 3.7.1.1. *Dufour et al. (2006)—Water Ingestion during Swimming Activities in a Pool: A Pilot Study; Dufour et al. (2017)—Ingestion of Swimming Pool Water by Recreational Swimmers*

Dufour et al. (2006) estimated the amount of water ingested while swimming, using cyanuric acid as an indicator of pool water ingestion exposure. Cyanuric acid is a breakdown product of chloroisocyanates, which are commonly used as disinfectant stabilizers in recreational water treatment. Because ingested cyanuric acid passes through the body unmetabolized (Allen et al., 1982), the volume of water ingested can be estimated based on the amount of cyanuric acid measured in the pool water and in the urine of swimmers, as follows:

$$V_{\text{pool water ingested}} = V_{\text{urine}} \times (CA_{\text{urine}} \div CA_{\text{pool}}) \quad \text{(Eqn. 3-1)}$$

where:

$V_{\text{pool water ingested}}$ = volume of pool water ingested (mL),

$V_{\text{urine}}$ = volume of urine collected over a 24-hour period (mL),

$CA_{\text{urine}}$ = concentration of cyanuric acid in urine (mg/L), and

$CA_{\text{pool}}$ = concentration of cyanuric acid in pool water (mg/L).

The assumption that ingested cyanuric acid passes through the body unmetabolized is based on a study by Allen et al. (1982) in which two volunteers ingested known amounts of cyanuric acid and collected their own urine for 24 hours thereafter. Allen et al. (1982) estimated the recovery of ingested cyanuric acid to be 98%. Also, according to Dufour et al. (2006), dermal absorption of cyanuric acid has been shown to be negligible. Thus, the concentration in urine was assumed to represent the amount ingested. Dufour et al. (2006) estimated pool water intake among 53 swimmers that participated in a pilot study at an outdoor swimming pool treated with chloroisocyanate. This pilot study population included 12 adults (4 males and 8 females) and 41 children under 18 years of age (20 males and 21 females). The study participants were asked not to swim for 24 hours before or after a 45-minute period of active swimming in the pool. Pool water samples were collected prior to the start of swimming activities, and swimmers' urine was collected for 24 hours after the swimming event ended. The pool water and urine sample were analyzed for cyanuric acid.

Table 3-91 presents the results of this pilot study. The mean volumes of water ingested over a 45-minute period were 16 mL (16/mL/0.75 hr = 21 mL/hr) for adults and 37 mL (37 mL/0.75 hr = 49 mL/hr) for children. The maximum volume of water ingested by adults was 53 mL/0.75 hr (71 mL/hr) and by children, was 154 mL/0.75 hr (205 mL/hr). The 97$^{th}$ percentile volume of water ingested by children was approximately 90 mL/0.75 hr (120 mL/hr).

This study is one of the first attempts to measure water ingested while swimming. However, the number of study participants was low, and data cannot be broken out by the recommended age categories (U.S. EPA, 2005).

Using the same approach as in the pilot study reported in Dufour et al. (2006), Dufour et al. (2017) investigated the ingestion of swimming pool water among a study population of 549 individuals at nine public swimming pools in the Columbus, Ohio area that had been disinfected with chloroisocyanurate. The study participants included both males and females in approximately equal numbers. The participants represented three age groups: children 6−10 years old ($N$ = 66), teens 11−15 years old ($N$ = 121), and adults,

defined as individuals 16 years and older ($N = 362$). Study participants were asked to perform normal swimming activities for approximately one hour and collect their own urine over the following 24 hours.

For all swimmers, the arithmetic mean pool water volume ingested was 32 mL/event and the geometric mean was 14 mL/event (Dufour et al., 2017). Table 3-92 provides the ingestion rates in units of mL/hour by age and sex, as reported by Dufour et al. (2017). Children 6−10 years old ingested more water per swimming event and spent nearly twice as much time in the water as older children and adults. The estimated geometric mean ingestion rate for children 6−10 years, and teens 11−15 years was 24 mL/hour. The estimated geometric mean ingestion rate for adults (ages 16 years and older) was 12 mL/hour, but adult males ingested water at a higher rate (16 mL/hour) than adult females (9 mL/hour). The 95$^{th}$ percentile ingestion rates were 96 mL/hour for children, 152 mL/hour for teens, and 105 mL/hour for adults (Dufour and Wymer, 2017).

Using data obtained from the authors (Dufour, 2017), arithmetic mean ingestion rates and additional percentiles of the distributions were estimated for additional age groups of children as shown in Table 3-93. The arithmetic mean ingestion rates were 38, 44, 33, and 28 mL/hour for ages 6 to <11, 11 to <16, 16 to <21, and 21+ years, respectively. The 95$^{th}$ percentile ingestion rates were 96, 152, 105, and 92 mL/hour for ages 6 to <11, 11 to <16, 16 to <21, and 21+ years, respectively.

This study provides estimated swimming pool water ingestion rates based on a large sample population, and the volumes of water ingested per event are relatively consistent with those of the pilot study. According to Dufour et al. (2017) "Caution must be taken in interpreting these derived numbers [i.e., ingestion rates] too strictly, given they are based on self-reported data (minutes in the water); thus, they could be less reliable because of the anecdotal propensity of children, and even adults, to under- or over-estimate how much time is spent in the water." As noted by Dufour et al. (2006), swimming behavior of pool swimmers may be similar to freshwater swimmers, but may differ from saltwater swimmers.

### 3.7.2. Relevant Studies on Water Ingestion While Swimming, Diving, or Engaging in Recreational Water Activities

The sections that follows provide summaries of the relevant studies on water ingestion while engaging in recreational water activities.

#### 3.7.2.1. *Schijven and de Roda Husman (2006)—A Survey of Diving Behavior and Accidental Occupational and Sport Divers to Assess the Risk of Infection with Waterborne Pathogenic Microorganisms*

Schijven and de Roda Husman (2006) estimated the amount of water ingested by occupational and sports divers in the Netherlands. Questionnaires were used to obtain information on the number of dives for various types of water bodies, and the approximate volume of water ingested per dive. Estimates of the amount of water ingested were made by comparing intake to common volumes (i.e., a few drops = 2.75 mL; shot glass = 25 mL; coffee cup = 100 mL; soda glass = 190 mL). The study was conducted among occupational divers in 2002 and among sports divers in 2003 and included responses from more than 500 divers. Table 3-94 provides the results of this study. On average, occupational divers ingested 9.8 mL/dive in marine water and 5.7 mL/dive in fresh water. Sports divers wearing an ordinary diving mask ingested 9.0 mL/dive marine water and 13 mL/dive fresh recreational water. Sports divers who wore full face masks ingested less water. The main limitation of this study is that no measurements were taken. It relies on estimates of the perceived amount of water ingested by the divers. Although these data are from the Netherlands, it is assumed that water ingestion among divers in the United States would be similar, and studies involving U.S. divers were not identified.

#### 3.7.2.2. *Schets et al. (2011)—Exposure Assessment for Swimmers in Bathing Waters and Swimming Pools*

Schets et al. (2011) collected exposure data for swimmers in fresh water, seawater, and swimming pools in 2007 and 2009. Information on the frequency, duration, and amount of water swallowed were collected via questionnaires administered to nearly 10,000 people in the Netherlands. Individuals 15 years of age and older were considered adults and answered questions for themselves, and a parent answered the questions for their eldest child under 15 years of age. Survey participants estimated the amount of water that they swallowed while swimming by responding in one of four ways: (1) none or only a few drops; (2) one or two mouthfuls; (3) three to five mouthfuls; or (4) six to eight mouthfuls. Schets et al. (2011) conducted a series of experiments to measure the amount of water that corresponded to a mouthful of water and converted the data in the four response categories to volumes of water ingested. Monte Carlo analyses were used to combine the distribution of volume

(i.e., mouthful) measurements with the distribution of responses in the four response categories to generate distributions of the amount of water swallowed per event for adult men and women, and children less than 15 year of age. Table 3-95 presents the means and 95% confidence intervals for the duration of swimming and amount of water ingested during swimming. Frequency data were also provided by Schets et al. (2011), but these data are not presented here because they are for the population of the Netherlands and may not be representative of swimming frequency in the United States. According to Schets et al. (2011), the mean volume of water ingested by children (<15 years) during an average swimming pool event lasting 81 minutes was 51 mL or 0.63 mL/min (38 mL/hour). The values for children were slightly lower for swimming in fresh water and seawater. For adults, the mean volume of water ingested ranged from 18 to 34 mL over swimming events lasting 41 to 68 minutes (see Table 3-95).

The advantages of this study are that it is based on a relatively large sample size and that data are provided for various types of swimming environments (i.e., pools, fresh water, and seawater). Although these data are from the Netherlands, and based primarily on self-reported estimates, the mean values reported in this study are similar to those based on measurements of cyanuric acid in the urine of U.S. swimmers as reported by Dufour et al. (2006).

#### 3.7.2.3. *Dorevitch et al. (2011)—Water Ingestion during Water Recreation*

Dorevitch et al. (2011) estimated the volumes of water ingested during "limited contact water recreation activities." These activities included canoeing, fishing, kayaking, motor boating, rowing, wading and splashing, and walking. Full contact scenarios (i.e., swimming and immersion) were also evaluated. Dorevitch et al. (2011) estimated water intake among individuals greater than 6 years of age using two different methods in studies conducted in 2009. In the first surface water study, self-reported estimates of ingestion were obtained via interview of 2,705 individuals after they had engaged in recreation activities in Chicago area surface waters. A total of 2,705 participants reported whether they swallowed no water, a drop or two, a teaspoon, or one or more mouthfuls of water during one of the five limited contact recreational activities (i.e., canoeing, fishing, kayaking, motor boating, and rowing). A second study was conducted in swimming pools where 662 participants engaged in limited contact scenarios (i.e., canoeing, simulated fishing, kayaking, motor boating, rowing, wading/splashing, and walking), as well as full contact activities such as swimming and immersion. Participants were interviewed after performing their water activity and reported on their estimated water ingestion. In addition, 24-hour urine samples were collected for analysis of cyanuric acid, a tracer of swimming pool water. Translation factors for each of the reported categories of ingestion (e.g., none, drop/teaspoon, mouthful) were developed using the results of the urine analyses. These translation factors were used to estimate the volume of water ingested for the various water activities evaluated in this study (Dorevitch et al., 2011). Table 3-96 presents the estimated volumes of water ingested for the limited and full contact scenarios. Swimmers had the highest estimated water intake (mean = 10 mL/hr; 95% upper confidence limit = 35 mL/hr) among the activities evaluated.

The advantage of this study is that it provides information on the estimated volume of water ingested during both limited and full contact recreational activities. However, the data are based on self-reporting, and data are not provided for individual age groups of the population.

#### 3.7.2.4. *Suppes et al. (2014)—Assessment of Swimmers Behaviors on Pool Water Ingestion*

Suppes et al. (2014) conducted a study at four swimming pools in Tucson, AZ in 2012. Pool water ingestion was estimated based on the concentration of cyanuric acid in the urine as in the Dufour et al. (2006, 2017) studies. Environmental sensors and videography techniques were also used to identify activities that might lead to increased water ingestion (e.g., head submersion, splashes of water to the face, duration of swimming activities). Questionnaires were used to collect information on age, gender, and type of swimming activity that participants engaged in (e.g., playing, diving, sitting, lap swimming). A total of 64 swimmers, ages 5 to 52 years old, participated in the study, and 35 of those who were videotaped also submitted useable 24-hour urine samples after swimming for a 45-minute period. The mean pool water ingestion rates for these 35 swimmers was reported to be 13.7 mL/hr (see Table 3-97). The age-group-specific ingestion rates were 3.5 mL/hr for adults (>18 years of age, $N = 19$) and 25.7 mL/hr for children (≤18 years of age, $N = 16$). The mean ingestion rate for children in this study was similar to the geometric mean ingestion rate for children (6 to 15 years of age) observed by Dufour et al. (2017). Leisure swimmers were more likely to ingest pool water than lap swimmers, and splashes of the water to the face, were associated with higher ingestion rates.

Associations between the number and duration of head submersions, as estimated by videography, and pool water ingestion rates were not observed. The environmental sensors were found to be less accurate for assessing the number and duration of head submersions when compared to use of videography. This study provides additional evidence of pool water ingestion among swimmers, but is based on a relatively small sample; the data for children were not provided according to age categories, and upper percentile (e.g., $90^{th}$ or $95^{th}$ percentile) values were not provided.

#### 3.7.2.5. *Sinclair et al. (2016a)—Variability in 24-Hour Excretion of Cyanuric Acid: Implications for Water Exposure Assessment*

Sinclair et al. (2016a) tested the assumption that the cyanuric acid ingested while swimming is completed excreted within 24 hours. In the Sinclair et al. (2016a) study, 26 volunteers (20−56 years of age; mostly male) drank a solution containing 1 mg of cyanuric acid and collected their own urine for 24 hours thereafter. The urine samples were then analyzed for cyanuric acid to estimate the amount that was excreted over the 24 hours post ingestion. The recovery of cyanuric acid over 24 hours varied among the 26 participants. The mean value was 85.3%, and the median was 94.5%, with 16 of the 26 individuals having excretion values ranging from 89 to 105%.

This study provides information on the excretion of cyanuric acid. The information is relevant to studies that use cyanuric acid levels in urine to estimate swimming pool water ingestion. The study was conducted in Australia, but excretion of cyanuric acid among that population would not be expected to differ from U.S. populations.

#### 3.7.2.6. *DeFlorio-Barker et al. (2017)—Child Environmental Exposures to Water and Sand at the Beach: Findings from Studies of Over 68,000 Subjects at 12 Beaches*

DeFlorio-Barker et al. (2017) estimated the amount of water ingested per beach water contact event by conducting simulations based on self-reported time spent in the water and the amount of water swallowed per minute. Data for the time spent in the water were based on data from interviews conducted in 2003−2009 at temperate beaches in the contiguous United States. (DeFlorio-Barker et al., 2017; Arnold et al., 2016). The survey data represented a total of 68,685 beachgoers; 21,015 at 4 freshwater beaches and 47,670 at 8 marine beaches. At both freshwater and marine beaches, approximately 67% of beachgoers had some form of contact with the water (e.g., wading, swimming, playing); 13,568 had water contact at freshwater beaches and 31,685 had water contact at marine beaches. Data on the amount of water swallowed per minute were based on swimming pool studies conducted by Dufour et al. (2017) using cyanuric acid as a biomarker of exposure, as described in Section 3.7.1.1.

Table 3-98 presents age-specific estimates of the amount of water swallowed per water contact event for freshwater, marine, and all types of beach locations combined based on these simulations. Children were found to ingest more water per event than adults, males were found to ingest more than females, and ingestion by individuals recreating at marine beaches tended to be higher than for those at freshwater beaches.

The advantage of this study is that it provides estimates of the volume of water ingested while recreating at freshwater and marine beaches. The estimates are based on the time spent in the water, and represent the amount swallowed per event in units of mL/event. These data may not be applicable to other types of water contact activities (e.g., water skiing or diving, swimming in a pool) where the time spent in the water may differ from that of beachgoers. Also, any uncertainties associated with recall data on the time spent in the water would also be applicable to these estimates.

## 3.8. OTHER INADVERTENT WATER INGESTION

### 3.8.1. Sinclair et al. (2016b)—Measuring Water Ingestion from Spray Exposures

Sinclair et al. (2016b) estimated the volume of water ingested from spray exposures. Twenty-six study participants, aged 18 to 25 years, engaged in a 10-minute simulated car wash activity using a high-pressure spray device and water treated with cyanuric acid. Study participants were asked not to swim in a cyanuric acid-treated swimming pool for 48 hours prior to the simulation and provided presimulation urine samples for a subset of the participants to verify the absence of cyanuric acid in the urine. All participants wore protective coveralls, gloves, waterproof footwear, and safety glasses during the simulation. After the simulations, 24-hour urine samples were collected and analyzed for cyanuric acid. Among the 26 participants, 18 had quantifiable levels of cyanuric acid in their urine after engaging in the simulation exercise; 6 had trace levels, and 2 had no detectable levels. As in the Dufour et al. (2006, 2017) studies, it was assumed that 100% of the cyanuric acid that was ingested was excreted in the urine (see Section 3.7.1.1). The maximum volume of

water ingested was estimated to be 3.79 mL, and the 10th, 50th, and 90th percentiles were 0.019, 0.175, and 1.84 mL, respectively. When the data were adjusted for potential variability in excretion among individuals, based on data from Sinclair et al. (2016a; see Section 3.7.2.5), the mean and 95th percentile volumes of water ingested were estimated to be 0.438 (SD 1.24) and 1.93 mL, respectively.

This study is based on a relatively small sample, but provides data for a scenario in which water may be inadvertently ingested. As noted by Sinclair et al. (2016b), while it is assumed that this exposure scenario represents ingestion alone, inhalation may have accounted for a portion of the exposures that occurred during the simulation. Thus, the ingestion estimates provided in Sinclair et al. (2016b) would be conservative estimates of ingestion exposures.

## 3.9. REFERENCES FOR CHAPTER 3

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**Table 3-9. Two-Day Average[a] per Capita[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Community Water (mL/day)**

| Population Group | Sample Size | Percent Consuming[d] | Mean | SE | Percentiles | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | Max |
| All ages | 24,673 | 65 | 711 | 27 | 0 | 0 | 0 | 0 | 338 | 1,107 | 1,994 | 2,641 | 4,066 | 8,634[e] |
| Age group | | | | | | | | | | | | | | |
| Birth to <1 month | 87 | 32 | 184 | 59 | 0[e] | 0[e] | 0[e] | 0 | 0 | 87 | 781[e] | 851[e] | 1,037[e] | 1,037[e] |
| 1 to <3 months | 233 | 19 | 145 | 32 | 0[e] | 0[e] | 0 | 0 | 0 | 0 | 734 | 905[e] | 1,224[e] | 1,403[e] |
| 3 to <6 months | 282 | 29 | 187 | 32 | 0[e] | 0[e] | 0 | 0 | 0 | 180 | 780 | 981[e] | 1,288[e] | 1,390[e] |
| 6 to <12 months | 588 | 48 | 269 | 29 | 0[e] | 0 | 0 | 0 | 0 | 552 | 876 | 988 | 1,168[e] | 1,797[e] |
| Birth to 1 year | 1,190 | 37 | 220 | 22 | 0[e] | 0 | 0 | 0 | 0 | 399 | 839 | 974 | 1,177[e] | 1,797[e] |
| 1 to <2 years | 728 | 59 | 146 | 13 | 0[e] | 0 | 0 | 0 | 48 | 240 | 378 | 565 | 813[e] | 2,619[e] |
| 2 to <3 years | 751 | 62 | 205 | 14 | 0[e] | 0 | 0 | 0 | 94 | 299 | 630 | 778 | 1,121[e] | 2,861[e] |
| 3 to <6 years | 1,418 | 61 | 208 | 14 | 0[e] | 0 | 0 | 0 | 111 | 333 | 588 | 741 | 1,074[e] | 2,179[e] |
| 6 to <11 years | 2,292 | 65 | 294 | 18 | 0 | 0 | 0 | 0 | 161 | 445 | 765 | 1,071 | 1,909 | 4,048[e] |
| 11 to <16 years | 2,551 | 56 | 315 | 28 | 0 | 0 | 0 | 0 | 71 | 427 | 932 | 1,395 | 2,650 | 5,120[e] |
| 16 to <21 years | 2,191 | 60 | 436 | 24 | 0 | 0 | 0 | 0 | 137 | 613 | 1,340 | 1,900 | 3,095 | 7,184[e] |
| 21 to <30 years | 2,082 | 66 | 781 | 45 | 0 | 0 | 0 | 0 | 364 | 1,191 | 2,127 | 2,848 | 5,009 | 7,504[e] |
| 30 to <40 years | 2,282 | 71 | 902 | 43 | 0 | 0 | 0 | 0 | 580 | 1,391 | 2,409 | 2,967 | 4,409 | 7,402[e] |
| 40 to <50 years | 2,378 | 65 | 880 | 48 | 0 | 0 | 0 | 0 | 546 | 1,389 | 2,371 | 2,964 | 4,474 | 7,041[e] |
| 50 to <60 years | 2,103 | 67 | 956 | 44 | 0 | 0 | 0 | 0 | 698 | 1,516 | 2,458 | 2,976 | 4,451 | 6,554[e] |
| 60 to <70 years | 2,214 | 68 | 941 | 58 | 0 | 0 | 0 | 0 | 732 | 1,534 | 2,315 | 2,972 | 3,885 | 8,634[e] |
| 70 to <80 years | 1,578 | 64 | 772 | 47 | 0[e] | 0 | 0 | 0 | 627 | 1,281 | 1,826 | 2,273 | 3,437[e] | 4,975[e] |
| 80+ years | 915 | 72 | 784 | 46 | 0[e] | 0 | 0 | 0 | 688 | 1,255 | 1,792 | 2,122 | 2,785[e] | 5,334[e] |
| Birth to <2 years | 1,918 | 48 | 185 | 15 | 0[e] | 0 | 0 | 0 | 0 | 266 | 699 | 858 | 1,159[e] | 2,619[e] |
| 2 to <16 years | 7,012 | 61 | 278 | 16 | 0 | 0 | 0 | 0 | 111 | 403 | 749 | 1,069 | 2,107 | 5,120[e] |
| 16 to <70 years | 13,250 | 67 | 845 | 33 | 0 | 0 | 0 | 0 | 502 | 1,335 | 2,273 | 2.906 | 4,375 | 8,633[e] |
| 21 to <50 years | 6,742 | 67 | 858 | 36 | 0 | 0 | 0 | 0 | 506 | 1,377 | 2,329 | 2,938 | 4,587 | 7,504[e] |
| 50+ years | 6,810 | 67 | 902 | 42 | 0 | 0 | 0 | 0 | 689 | 1,428 | 2,239 | 2,827 | 4,066 | 8,634[e] |
| Race | | | | | | | | | | | | | | |
| Mexican American | 5,787 | 55 | 433 | 32 | 0 | 0 | 0 | 0 | 87 | 593 | 1,297 | 1,867 | 3,397 | 7,504[e] |
| Non-Hispanic black | 5,337 | 66 | 516 | 24 | 0 | 0 | 0 | 0 | 238 | 711 | 1,440 | 2,049 | 3,633 | 7,402[e] |
| Non-Hispanic white | 10,294 | 66 | 796 | 36 | 0 | 0 | 0 | 0 | 438 | 1,272 | 2,173 | 2,794 | 4,165 | 8,634[e] |
| Other Hispanic | 2,082 | 62 | 566 | 43 | 0 | 0 | 0 | 0 | 216 | 823 | 1,582 | 2,441 | 4,318 | 7,184[e] |
| Other race—including multiple | 1,173 | 66 | 721 | 60 | 0[e] | 0 | 0 | 0 | 407 | 1,118 | 1,900 | 2,567 | 3,878[e] | 7,018[e] |

**Table 3-9. Two-Day Average[a] per Capita[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Community Water (mL/day) (Continued)**

[a] Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/.
[b] Includes all participants whether or not they ingested any water from the source during survey period.
[c] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[d] Represents the percentage of individuals consuming at least once over the 2-day survey period.
[e] Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).
HNIS = Human Nutrition Information Service.
NCHS = National Center for Health Statistics.
SE = Standard error.

Source: U.S. EPA analysis of NHANES 2005−2010 data using http://fcid.foodrisk.org/.

**Table 3-10. Two-Day Average[a] per Capita[b] Estimates of Direct[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Bottled Water (mL/day)**

| Population Group | Sample Size | Percent Consuming[d] | Mean | SE | Percentiles | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | Max |
| All ages | 24,673 | 44 | 326 | 13 | 0 | 0 | 0 | 0 | 0 | 428 | 1,066 | 1,570 | 2,666 | 8,834[e] |
| Age group | | | | | | | | | | | | | | |
| Birth to <1 month | 87 | 19 | 7 | 3 | 0[e] | 0[e] | 0[e] | 0 | 0 | 0 | 15[e] | 44[e] | 155[e] | 296[e] |
| 1 to <3 months | 233 | 12 | 8 | 3 | 0[e] | 0[e] | 0 | 0 | 0 | 0 | 15 | 44[e] | 192[e] | 192[e] |
| 3 to <6 months | 282 | 18 | 11 | 2 | 0[e] | 0[e] | 0 | 0 | 0 | 0 | 44 | 89[e] | 133[e] | 178[e] |
| 6 to <12 months | 588 | 31 | 34 | 4 | 0[e] | 0 | 0 | 0 | 0 | 30 | 119 | 178 | 333[e] | 680[e] |
| Birth to <1 year | 1,190 | 23 | 22 | 2 | 0[e] | 0 | 0 | 0 | 0 | 0 | 82 | 133 | 281[e] | 680[e] |
| 1 to <2 years | 728 | 38 | 71 | 7 | 0[e] | 0 | 0 | 0 | 0 | 89 | 241 | 356 | 633[e] | 790[e] |
| 2 to <3 years | 751 | 39 | 105 | 12 | 0[e] | 0 | 0 | 0 | 0 | 119 | 333 | 533 | 1,133[e] | 4,205[e] |
| 3 to <6 years | 1,418 | 40 | 121 | 10 | 0[e] | 0 | 0 | 0 | 0 | 148 | 389 | 578 | 1,092[e] | 1,762[e] |
| 6 to <11 years | 2,292 | 42 | 156 | 10 | 0 | 0 | 0 | 0 | 0 | 237 | 474 | 731 | 1,252 | 4,717[e] |
| 11 to <16 years | 2,551 | 45 | 235 | 16 | 0 | 0 | 0 | 0 | 0 | 296 | 689 | 1,095 | 1,874 | 4,322[e] |
| 16 to <21 years | 2,191 | 50 | 380 | 26 | 0 | 0 | 0 | 0 | 96 | 563 | 1,125 | 1,500 | 2,678 | 5,810[e] |
| 21 to <30 years | 2,082 | 52 | 459 | 28 | 0 | 0 | 0 | 0 | 119 | 724 | 1,460 | 1,888 | 2,930 | 7,673[e] |
| 30 to <40 years | 2,282 | 52 | 468 | 29 | 0 | 0 | 0 | 0 | 96 | 711 | 1,422 | 1,965 | 3,237 | 6,636[e] |
| 40 to <50 years | 2,378 | 50 | 427 | 21 | 0 | 0 | 0 | 0 | 0 | 595 | 1,303 | 1,896 | 3,018 | 8,834[e] |
| 50 to <60 years | 2,103 | 42 | 342 | 23 | 0 | 0 | 0 | 0 | 0 | 474 | 1,166 | 1,751 | 2,666 | 4,513[e] |
| 60 to <70 years | 2,214 | 39 | 278 | 19 | 0 | 0 | 0 | 0 | 0 | 355 | 970 | 1,461 | 2,266 | 5,024[e] |
| 70 to <80 years | 1,578 | 30 | 190 | 16 | 0[e] | 0 | 0 | 0 | 0 | 156 | 711 | 1,093 | 2,184[e] | 3,228[e] |
| 80+ years | 915 | 19 | 108 | 15 | 0[e] | 0 | 0 | 0 | 0 | 0 | 370 | 737 | 1,639[e] | 6,213[e] |
| Birth to <2 years | 1,918 | 30 | 45 | 4 | 0[e] | 0 | 0 | 0 | 0 | 40 | 156 | 267 | 578[e] | 790[e] |
| 2 to <16 years | 7,012 | 43 | 174 | 9 | 0 | 0 | 0 | 0 | 0 | 250 | 533 | 778 | 1,642 | 4,717[e] |
| 16 to <70 years | 13,250 | 48 | 400 | 17 | 0 | 0 | 0 | 0 | 0 | 592 | 1,259 | 1,784 | 2,948 | 8,834[e] |
| 21 to <50 years | 6,742 | 51 | 451 | 20 | 0 | 0 | 0 | 0 | 74 | 674 | 1,400 | 1,925 | 3,184 | 8,834[e] |
| 50+ years | 6,810 | 37 | 273 | 14 | 0 | 0 | 0 | 0 | 0 | 296 | 947 | 1,462 | 2,370 | 6,213[e] |
| Race | | | | | | | | | | | | | | |
| Mexican American | 5,787 | 60 | 428 | 26 | 0 | 0 | 0 | 0 | 167 | 615 | 1,275 | 1,746 | 2,784 | 6,213[e] |
| Non-Hispanic black | 5,337 | 52 | 391 | 20 | 0 | 0 | 0 | 0 | 74 | 533 | 1,199 | 1,711 | 3,018 | 6,634[e] |
| Non-Hispanic white | 10,294 | 40 | 290 | 13 | 0 | 0 | 0 | 0 | 0 | 326 | 963 | 1,483 | 2,503 | 8,834[e] |
| Other Hispanic | 2,082 | 55 | 432 | 34 | 0 | 0 | 0 | 0 | 118 | 580 | 1,303 | 1,974 | 2,910 | 7,673[e] |
| Other race—including multiple | 1,173 | 49 | 351 | 30 | 0[e] | 0 | 0 | 0 | 0 | 501 | 1,076 | 1,583 | 2,714[e] | 4,717[e] |

**Table 3-10. Two-Day Average[a] per Capita[b] Estimates of Direct[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Bottled Water (mL/day) (Continued)**

[a] Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/.
[b] Includes all participants whether or not they ingested any water from the source during survey period.
[c] Direct water is defined as water ingested directly as a beverage; indirect water, defined as water added in the preparation of food or beverages, was not accounted for in the estimation of bottled water intake.
[d] Represents the percentage of individuals consuming at least once over the 2-day survey period.
[e] Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).
HNIS = Human Nutrition Information Service.
NCHS = National Center for Health Statistics.
SE = Standard error.

Source: U.S. EPA analysis of NHANES 2005−2010 data using http://fcid.foodrisk.org/.

**Table 3-11. Two-Day Average[a] per Capita[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Other Sources (mL/day)**

| Population Group | Sample Size | Percent Consuming[d] | Mean | SE | Percentiles | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | Max |
| All ages | 24,673 | 33 | 272 | 24 | 0 | 0 | 0 | 0 | 0 | 200 | 948 | 1,571 | 3,117 | 8,398[e] |
| Age group | | | | | | | | | | | | | | |
| Birth to <1 month | 87 | 45 | 273 | 51 | 0[e] | 0[e] | 0[e] | 0 | 0 | 590 | 745[e] | 860[e] | 936[e] | 1,011[e] |
| 1 to <3 months | 233 | 50 | 351 | 39 | 0[e] | 0[e] | 0 | 0 | 0 | 710 | 911 | 1,055[e] | 1,154[e] | 1,489[e] |
| 3 to <6 months | 282 | 53 | 355 | 39 | 0[e] | 0[e] | 0 | 0 | 15 | 758 | 971 | 1,154[e] | 1,391[e] | 1,424[e] |
| 6 to <12 months | 588 | 49 | 274 | 24 | 0[e] | 0 | 0 | 0 | 0 | 581 | 852 | 1,023 | 1,359[e] | 1,486[e] |
| Birth to <1 year | 1,190 | 50 | 307 | 21 | 0[e] | 0 | 0 | 0 | 0 | 665 | 878 | 1,048 | 1,315[e] | 1,489[e] |
| 1 to <2 years | 728 | 37 | 77 | 11 | 0[e] | 0 | 0 | 0 | 0 | 94 | 280 | 356 | 725[e] | 1,485[e] |
| 2 to <3 years | 751 | 35 | 93 | 13 | 0[e] | 0 | 0 | 0 | 0 | 88 | 326 | 524 | 914[e] | 2,284[e] |
| 3 to <6 years | 1,418 | 36 | 84 | 8 | 0[e] | 0 | 0 | 0 | 0 | 89 | 269 | 481 | 889[e] | 4,698[e] |
| 6 to <11 years | 2,292 | 32 | 105 | 12 | 0 | 0 | 0 | 0 | 0 | 82 | 387 | 614 | 1,100 | 2,437[e] |
| 11 to <16 years | 2,551 | 39 | 198 | 18 | 0 | 0 | 0 | 0 | 0 | 202 | 703 | 1,078 | 2,252 | 3,911[e] |
| 16 to <21 years | 2,191 | 34 | 217 | 34 | 0 | 0 | 0 | 0 | 0 | 153 | 707 | 1,221 | 2,682 | 7,815[e] |
| 21 to <30 years | 2,082 | 30 | 194 | 29 | 0 | 0 | 0 | 0 | 0 | 92 | 614 | 1,005 | 2,800 | 8,127[e] |
| 30 to <40 years | 2,282 | 28 | 262 | 38 | 0 | 0 | 0 | 0 | 0 | 97 | 867 | 1,798 | 3,304 | 7,459[e] |
| 40 to <50 years | 2,378 | 33 | 372 | 40 | 0 | 0 | 0 | 0 | 0 | 389 | 1,324 | 2,065 | 3,843 | 8,398[e] |
| 50 to <60 years | 2,103 | 32 | 401 | 40 | 0 | 0 | 0 | 0 | 0 | 423 | 1,407 | 2,178 | 4,113 | 7,600[e] |
| 60 to <70 years | 2,214 | 32 | 332 | 40 | 0 | 0 | 0 | 0 | 0 | 404 | 1,223 | 1,766 | 2,989 | 7,447[e] |
| 70 to <80 years | 1,578 | 36 | 397 | 39 | 0[e] | 0 | 0 | 0 | 0 | 582 | 1,495 | 1,938 | 2,754[e] | 5,316[e] |
| 80+ years | 915 | 28 | 250 | 33 | 0[e] | 0 | 0 | 0 | 0 | 282 | 936 | 1,334 | 1,952[e] | 3,917[e] |
| Birth to <2 years | 1,918 | 44 | 198 | 14 | 0[e] | 0 | 0 | 0 | 0 | 289 | 741 | 903 | 1,232[e] | 1,489[e] |
| 2 to <16 years | 7,012 | 36 | 135 | 9 | 0 | 0 | 0 | 0 | 0 | 115 | 457 | 737 | 1,456 | 4,698[e] |
| 16 to <70 years | 13,250 | 31 | 304 | 29 | 0 | 0 | 0 | 0 | 0 | 225 | 1,066 | 1,779 | 3,456 | 8,398[e] |
| 21 to <50 years | 6,742 | 31 | 281 | 32 | 0 | 0 | 0 | 0 | 0 | 173 | 963 | 1,725 | 3,383 | 8,398[e] |
| 50+ years | 6,810 | 32 | 365 | 33 | 0 | 0 | 0 | 0 | 0 | 431 | 1,323 | 1,918 | 3,574 | 7,600[e] |
| Race | | | | | | | | | | | | | | |
| Mexican American | 5,787 | 45 | 202 | 12 | 0 | 0 | 0 | 0 | 0 | 249 | 631 | 938 | 2,186 | 5,036[e] |
| Non-Hispanic black | 5,337 | 29 | 128 | 10 | 0 | 0 | 0 | 0 | 0 | 59 | 462 | 721 | 1,569 | 4,911[e] |
| Non-Hispanic white | 10,294 | 32 | 317 | 32 | 0 | 0 | 0 | 0 | 0 | 229 | 1,147 | 1,824 | 3,402 | 8,398[e] |
| Other Hispanic | 2,082 | 40 | 166 | 15 | 0 | 0 | 0 | 0 | 0 | 181 | 610 | 832 | 1,446 | 3,680[e] |
| Other race—including multiple | 1,173 | 34 | 251 | 31 | 0[e] | 0 | 0 | 0 | 0 | 267 | 811 | 1,324 | 3,004[e] | 4,562[e] |

**Table 3-11. Two-Day Average[a] per Capita[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Other Sources (mL/day) (Continued)**

[a] Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/.
[b] Includes all participants whether or not they ingested any water from the source during survey period.
[c] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[d] Represents the percentage of individuals consuming at least once over the 2-day survey period.
[e] Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).
HNIS = Human Nutrition Information Service.
NCHS = National Center for Health Statistics.
SE = Standard error.

Source: U.S. EPA analysis of NHANES 2005−2010 data using http://fcid.foodrisk.org/.

**Table 3-12. Two-Day Average[a] per Capita[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: All Sources (mL/day)**

| Population Group | Sample Size | Percent Consuming[d] | Mean | SE | Percentiles | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | Max |
| All ages | 24,673 | 99 | 1,309 | 19 | 0 | 105 | 221 | 527 | 1,061 | 1,827 | 2,698 | 3,292 | 4,767 | 10,280[e] |
| Age group | | | | | | | | | | | | | | |
| Birth to <1 month | 87 | 78 | 464 | 53 | 0[e] | 0[e] | 0[e] | 40 | 580 | 745 | 860[e] | 945[e] | 1,037[e] | 1,234[e] |
| 1 to <3 months | 233 | 78 | 505 | 30 | 0[e] | 0[e] | 0 | 0 | 603 | 847 | 1,030 | 1,124[e] | 1,265[e] | 1,489[e] |
| 3 to <6 months | 282 | 83 | 552 | 30 | 0[e] | 0[e] | 0 | 105 | 634 | 844 | 1,065 | 1,207[e] | 1,391[e] | 1,456[e] |
| 6 to <12 months | 588 | 98 | 576 | 21 | 0[e] | 19 | 66 | 265 | 603 | 829 | 1,024 | 1,168 | 1,383[e] | 1,797[e] |
| Birth to <1 year | 1,190 | 87 | 549 | 16 | 0[e] | 0 | 0 | 169 | 598 | 829 | 1,030 | 1,159 | 1,388[c] | 1,797[e] |
| 1 to <2 years | 728 | 98 | 293 | 12 | 0[e] | 15 | 50 | 144 | 248 | 369 | 614 | 768 | 934[e] | 2,619[e] |
| 2 to <3 years | 751 | 99 | 403 | 16 | 0[e] | 43 | 75 | 165 | 327 | 561 | 831 | 1,001 | 1,317[e] | 4,205[e] |
| 3 to <6 years | 1,418 | 99 | 413 | 11 | 3[e] | 45 | 88 | 184 | 339 | 566 | 816 | 980 | 1,495[e] | 4,698[e] |
| 6 to <11 years | 2,292 | 98 | 555 | 17 | 0 | 42 | 105 | 237 | 469 | 754 | 1,106 | 1,389 | 2,305 | 5,473[e] |
| 11 to <16 years | 2,551 | 98 | 748 | 30 | 0 | 34 | 89 | 296 | 573 | 999 | 1,556 | 2,242 | 3,402 | 5,120[e] |
| 16 to <21 years | 2,191 | 97 | 1,033 | 36 | 0 | 24 | 125 | 356 | 883 | 1,447 | 2,201 | 2,741 | 3,742 | 7,815[e] |
| 21 to <30 years | 2,082 | 98 | 1,435 | 49 | 0 | 121 | 274 | 614 | 1,202 | 1,947 | 2,867 | 3,600 | 5,259 | 8,325[e] |
| 30 to <40 years | 2,282 | 99 | 1,632 | 39 | 22 | 233 | 383 | 792 | 1,401 | 2,252 | 3,149 | 3,857 | 5,135 | 7,459[e] |
| 40 to <50 years | 2,378 | 99 | 1,680 | 46 | 23 | 246 | 441 | 859 | 1,471 | 2,272 | 3,144 | 3,821 | 5,091 | 10,280[e] |
| 50 to <60 years | 2,103 | 100 | 1,698 | 38 | 54 | 254 | 485 | 915 | 1,498 | 2,245 | 3,065 | 3,925 | 5,349 | 7,600[e] |
| 60 to <70 years | 2,214 | 100 | 1,551 | 37 | 106 | 365 | 527 | 889 | 1,363 | 2,082 | 2,746 | 3,205 | 4,160 | 8,634[e] |
| 70 to <80 years | 1,578 | 99 | 1,359 | 28 | 88[e] | 357 | 486 | 841 | 1,272 | 1,728 | 2,366 | 2,748 | 3,619[e] | 5,316[e] |
| 80+ years | 915 | 100 | 1,142 | 26 | 170[e] | 317 | 429 | 698 | 1,007 | 1,493 | 1,953 | 2,296 | 3,236[e] | 7,054[e] |
| Birth to <2 years | 1,918 | 92 | 428 | 13 | 0[e] | 0 | 15 | 149 | 320 | 704 | 903 | 1,058 | 1,359[e] | 2,619[e] |
| 2 to <16 years | 7,012 | 98 | 587 | 15 | 0 | 39 | 89 | 227 | 456 | 767 | 1,205 | 1,571 | 2,769 | 5,473[e] |
| 16 to <70 years | 13,250 | 99 | 1,549 | 25 | 4 | 185 | 354 | 758 | 1,336 | 2,112 | 2,968 | 3,633 | 5,135 | 10,280[e] |
| 21 to <50 years | 6,742 | 99 | 1,590 | 33 | 7 | 194 | 363 | 758 | 1,369 | 2,170 | 3,082 | 3,760 | 5,167 | 10,280[e] |
| 50+ years | 6,810 | 100 | 1,540 | 25 | 72 | 310 | 487 | 853 | 1,354 | 2,016 | 2,796 | 3,363 | 4,650 | 8,634[e] |
| Race | | | | | | | | | | | | | | |
| Mexican American | 5,787 | 99 | 1,064 | 27 | 7 | 97 | 185 | 392 | 807 | 1,453 | 2,248 | 2,872 | 4,490 | 7,504[e] |
| Non-Hispanic black | 5,337 | 98 | 1,035 | 25 | 0 | 69 | 170 | 398 | 795 | 1,391 | 2,246 | 2,800 | 4,393 | 7,519[e] |
| Non-Hispanic white | 10,294 | 99 | 1,403 | 26 | 0 | 112 | 247 | 597 | 1,191 | 1,962 | 2,820 | 3,410 | 4,851 | 10,280[e] |
| Other Hispanic | 2,082 | 99 | 1,164 | 44 | 0 | 97 | 185 | 426 | 888 | 1,589 | 2,532 | 3,307 | 4,584 | 8,325[e] |
| Other race—including multiple | 1,173 | 99 | 1,323 | 48 | 20[e] | 163 | 274 | 571 | 1,115 | 1,815 | 2,656 | 3,278 | 4,397[e] | 7,018[e] |

**Table 3-12. Two-Day Average[a] per Capita[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: All Sources (mL/day) (Continued)**

| | |
|---|---|
| [a] | Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/. |
| [b] | Includes all participants whether or not they ingested any water from the source during survey period. |
| [c] | Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages. Does not include indirect consumption of bottled water. |
| [d] | Represents the percentage of individuals consuming at least once over the 2-day survey period. |
| [e] | Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993). |
| HNIS | = Human Nutrition Information Service. |
| NCHS | = National Center for Health Statistics. |
| SE | = Standard error. |
| Source: | U.S. EPA analysis of NHANES 2005−2010 data using http://fcid.foodrisk.org/. |

**Table 3-13. Two-Day Average[a] per Capita[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Community Water (mL/kg-day)**

| Population Group | Sample Size | Percent Consuming[d] | Mean | SE | Percentiles | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | Max |
| All ages | 24,673 | 65 | 10.7 | 0.4 | 0 | 0 | 0 | 0 | 5.8 | 16.3 | 28.6 | 37.1 | 64.1 | 267.5[e] |
| Age group | | | | | | | | | | | | | | |
| Birth to <1 month | 87 | 32 | 42.0 | 13.6 | 0[e] | 0[e] | 0[e] | 0 | 0 | 20.8 | 191.5[e] | 199.6[e] | 253.0[e] | 253.0[e] |
| 1 to <3 months | 233 | 19 | 25.3 | 5.4 | 0[e] | 0[e] | 0 | 0 | 0 | 0 | 128.4 | 163.7[e] | 267.2[e] | 267.5[e] |
| 3 to <6 months | 282 | 29 | 26.7 | 5.1 | 0[e] | 0[e] | 0 | 0 | 0 | 24.8 | 102.1 | 140.6[e] | 187.6[e] | 252.6[e] |
| 6 to <12 months | 588 | 48 | 30.2 | 3.3 | 0[e] | 0 | 0 | 0 | 0 | 60.7 | 98.6 | 112.1 | 139.9[e] | 213.9[e] |
| Birth to <1 year | 1,190 | 37 | 29.2 | 3.1 | 0[e] | 0 | 0 | 0 | 0 | 48.4 | 108.2 | 136.7 | 192.2[e] | 267.5[e] |
| 1 to <2 years | 728 | 59 | 13.1 | 1.1 | 0[e] | 0 | 0 | 0 | 4.3 | 21.0 | 34.4 | 50.8 | 75.6[e] | 216.4[e] |
| 2 to <3 years | 751 | 62 | 14.8 | 1.0 | 0[e] | 0 | 0 | 0 | 7.0 | 21.6 | 44.1 | 58.1 | 78.2[e] | 227.1[e] |
| 3 to <6 years | 1,418 | 61 | 11.5 | 0.8 | 0[e] | 0 | 0 | 0 | 6.1 | 18.4 | 32.6 | 42.1 | 55.7[e] | 126.6[e] |
| 6 to <11 years | 2,292 | 65 | 9.9 | 0.6 | 0 | 0 | 0 | 0 | 5.2 | 15.0 | 26.2 | 33.9 | 58.2 | 157.4[e] |
| 11 to <16 years | 2,551 | 56 | 5.8 | 0.5 | 0 | 0 | 0 | 0 | 1.2 | 8.1 | 16.7 | 25.7 | 51.4 | 81.9[e] |
| 16 to <21 years | 2,191 | 60 | 6.2 | 0.3 | 0 | 0 | 0 | 0 | 2.0 | 8.9 | 18.7 | 27.6 | 41.0 | 82.0[e] |
| 21 to <30 years | 2,082 | 66 | 10.5 | 0.6 | 0 | 0 | 0 | 0 | 4.9 | 16.3 | 28.7 | 38.9 | 64.1 | 99.9[e] |
| 30 to <40 years | 2,282 | 71 | 11.2 | 0.6 | 0 | 0 | 0 | 0 | 7.3 | 16.9 | 29.5 | 37.8 | 56.5 | 91.9[e] |
| 40 to <50 years | 2,378 | 65 | 11.1 | 0.6 | 0 | 0 | 0 | 0 | 6.7 | 17.6 | 30.4 | 38.3 | 61.2 | 110.1[e] |
| 50 to <60 years | 2,103 | 67 | 11.9 | 0.6 | 0 | 0 | 0 | 0 | 8.6 | 18.3 | 30.6 | 37.0 | 58.0 | 103.4[e] |
| 60 to <70 years | 2,214 | 68 | 11.7 | 0.7 | 0 | 0 | 0 | 0 | 9.0 | 18.6 | 29.5 | 35.3 | 53.0 | 120.7[e] |
| 70 to <80 years | 1,578 | 64 | 10.4 | 0.7 | 0[e] | 0 | 0 | 0 | 7.8 | 16.8 | 25.0 | 30.8 | 55.1[e] | 80.8[e] |
| 80+ years | 915 | 72 | 11.3 | 0.7 | 0[e] | 0 | 0 | 0 | 9.5 | 18.0 | 26.2 | 30.4 | 41.4[e] | 64.8[e] |
| Birth to <2 years | 1,918 | 48 | 21.6 | 1.9 | 0[e] | 0 | 0 | 0 | 0 | 23.2 | 78.5 | 111.6 | 174.2[e] | 267.5[e] |
| 2 to <16 years | 7,012 | 61 | 9.1 | 0.4 | 0 | 0 | 0 | 0 | 3.5 | 13.2 | 26.0 | 35.4 | 62.2 | 227.1[e] |
| 16 to <70 years | 13,250 | 67 | 10.7 | 0.4 | 0 | 0 | 0 | 0 | 6.3 | 16.9 | 29.3 | 36.7 | 58.3 | 120.7[e] |
| 21 to <50 years | 6,742 | 67 | 11.0 | 0.5 | 0 | 0 | 0 | 0 | 6.3 | 17.0 | 29.6 | 38.3 | 60.7 | 110.1[e] |
| 50+ years | 6,810 | 67 | 11.5 | 0.6 | 0 | 0 | 0 | 0 | 8.6 | 18.1 | 29.1 | 35.2 | 53.9 | 120.7[e] |
| Race | | | | | | | | | | | | | | |
| Mexican American | 5,787 | 55 | 7.4 | 0.5 | 0 | 0 | 0 | 0 | 1.7 | 10.2 | 21.0 | 30.0 | 56.3 | 244.4[e] |
| Non-Hispanic black | 5,337 | 66 | 7.9 | 0.4 | 0 | 0 | 0 | 0 | 3.6 | 11.5 | 21.2 | 28.4 | 51.1 | 267.5[e] |
| Non-Hispanic white | 10,294 | 66 | 11.7 | 0.5 | 0 | 0 | 0 | 0 | 7.1 | 18.3 | 30.3 | 39.0 | 64.5 | 252.6[e] |
| Other Hispanic | 2,082 | 62 | 9.1 | 0.6 | 0 | 0 | 0 | 0 | 4.3 | 13.1 | 24.3 | 34.4 | 53.1 | 224.0[e] |
| Other race—including multiple | 1,173 | 66 | 12.7 | 1.0 | 0[e] | 0 | 0 | 0 | 7.8 | 19.1 | 32.9 | 43.7 | 82.5[e] | 227.1[e] |

**Table 3-13. Two-Day Average[a] per Capita[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Community Water (mL/kg-day) (Continued)**

[a] Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/.
[b] Includes all participants whether or not they ingested any water from the source during survey period.
[c] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[d] Represents the percentage of individuals consuming at least once over the 2-day survey period.
[e] Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).
HNIS = Human Nutrition Information Service.
NCHS = National Center for Health Statistics.
SE = Standard error.

Source: U.S. EPA analysis of NHANES 2005−2010 data using http://fcid.foodrisk.org/.

**Table 3-14. Two-Day Average[a] per Capita[b] Estimates of Direct[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Bottled (mL/kg-day)**

| Population Group | Sample Size | Percent Consuming[d] | Mean | SE | Percentiles | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | Max |
| All ages | 24,673 | 44 | 4.9 | 0.2 | 0 | 0 | 0 | 0 | 0 | 6.6 | 15.5 | 22.3 | 39.1 | 316.2[e] |
| Age group | | | | | | | | | | | | | | |
| Birth to <1 month | 87 | 19 | 1.6 | 0.6 | 0[e] | 0[e] | 0[e] | 0 | 0 | 0 | 3.0[e] | 10.8[e] | 31.1[e] | 63.0[e] |
| 1 to <3 months | 233 | 12 | 1.4 | 0.4 | 0[e] | 0[e] | 0 | 0 | 0 | 0 | 2.4 | 8.4[e] | 29.6[e] | 31.5[e] |
| 3 to <6 months | 282 | 18 | 1.5 | 0.3 | 0[e] | 0[e] | 0 | 0 | 0 | 0 | 5.7 | 11.9[e] | 19.3[e] | 28.2[e] |
| 6 to <12 months | 588 | 31 | 3.6 | 0.4 | 0[e] | 0 | 0 | 0 | 0 | 3.8 | 13.5 | 20.9 | 35.6[e] | 71.5[e] |
| Birth to <1 year | 1,190 | 23 | 2.6 | 0.3 | 0[e] | 0 | 0 | 0 | 0 | 0 | 9.5 | 15.2 | 31.6[e] | 71.5[e] |
| 1 to <2 years | 728 | 38 | 6.3 | 0.6 | 0[e] | 0 | 0 | 0 | 0 | 7.7 | 22.9 | 31.6 | 52.0[e] | 78.5[e] |
| 2 to <3 years | 751 | 39 | 7.6 | 0.8 | 0[e] | 0 | 0 | 0 | 0 | 8.7 | 23.3 | 38.5 | 72.3[e] | 316.2[e] |
| 3 to <6 years | 1,418 | 40 | 6.7 | 0.6 | 0[e] | 0 | 0 | 0 | 0 | 8.4 | 21.4 | 31.8 | 64.9[e] | 105.8[e] |
| 6 to <11 years | 2,292 | 42 | 5.0 | 0.3 | 0 | 0 | 0 | 0 | 0 | 7.1 | 15.3 | 23.0 | 47.9 | 114.5[e] |
| 11 to <16 years | 2,551 | 45 | 4.2 | 0.3 | 0 | 0 | 0 | 0 | 0 | 5.9 | 12.5 | 19.0 | 34.1 | 66.8[e] |
| 16 to <21 years | 2,191 | 50 | 5.6 | 0.4 | 0 | 0 | 0 | 0 | 1.3 | 8.4 | 16.8 | 23.5 | 40.9 | 106.4[e] |
| 21 to <30 years | 2,082 | 52 | 6.0 | 0.4 | 0 | 0 | 0 | 0 | 1.6 | 9.1 | 18.9 | 24.8 | 37.5 | 103.3[e] |
| 30 to <40 years | 2,282 | 52 | 5.9 | 0.4 | 0 | 0 | 0 | 0 | 1.2 | 9.0 | 17.8 | 24.8 | 40.7 | 84.1[e] |
| 40 to <50 years | 2,378 | 50 | 5.3 | 0.3 | 0 | 0 | 0 | 0 | 0 | 7.9 | 16.6 | 22.4 | 38.2 | 166.7[e] |
| 50 to <60 years | 2,103 | 42 | 4.1 | 0.3 | 0 | 0 | 0 | 0 | 0 | 5.6 | 13.6 | 20.0 | 33.1 | 75.2[e] |
| 60 to <70 years | 2,214 | 39 | 3.5 | 0.3 | 0 | 0 | 0 | 0 | 0 | 4.2 | 12.3 | 18.7 | 28.2 | 68.5[e] |
| 70 to <80 years | 1,578 | 30 | 2.5 | 0.2 | 0[e] | 0 | 0 | 0 | 0 | 1.9 | 9.2 | 14.8 | 28.5[e] | 48.1[e] |
| 80+ years | 915 | 19 | 1.6 | 0.2 | 0[e] | 0 | 0 | 0 | 0 | 0 | 5.0 | 10.1 | 22.8[e] | 80.9[e] |
| Birth to <2 years | 1,918 | 30 | 4.3 | 0.3 | 0[e] | 0 | 0 | 0 | 0 | 4.1 | 14.7 | 26.2 | 48.4[e] | 78.5[e] |
| 2 to <16 years | 7,012 | 43 | 5.2 | 0.3 | 0 | 0 | 0 | 0 | 0 | 6.8 | 16.4 | 24.1 | 44.4 | 316.2[e] |
| 16 to <70 years | 13,250 | 48 | 5.1 | 0.2 | 0 | 0 | 0 | 0 | 0 | 7.3 | 16.2 | 22.4 | 37.0 | 166.7[e] |
| 21 to <50 years | 6,742 | 51 | 5.7 | 0.3 | 0 | 0 | 0 | 0 | 1.0 | 8.5 | 17.6 | 23.8 | 39.2 | 166.7[e] |
| 50+ years | 6,810 | 37 | 3.4 | 0.2 | 0 | 0 | 0 | 0 | 0 | 3.8 | 12.0 | 18.0 | 29.9 | 80.9[e] |
| Race | | | | | | | | | | | | | | |
| Mexican American | 5,787 | 60 | 7.2 | 0.4 | 0 | 0 | 0 | 0 | 3.3 | 10.7 | 20.0 | 25.7 | 46.4 | 114.5[e] |
| Non-Hispanic black | 5,337 | 52 | 5.5 | 0.2 | 0 | 0 | 0 | 0 | 1.3 | 7.9 | 16.7 | 23.5 | 38.4 | 84.2[e] |
| Non-Hispanic white | 10,294 | 40 | 4.2 | 0.2 | 0 | 0 | 0 | 0 | 0 | 5.1 | 13.9 | 20.5 | 35.6 | 166.7[e] |
| Other Hispanic | 2,082 | 55 | 7.2 | 0.6 | 0 | 0 | 0 | 0 | 2.1 | 9.6 | 20.4 | 29.7 | 51.1 | 316.2[e] |
| Other race—including multiple | 1,173 | 49 | 6.0 | 0.5 | 0[e] | 0 | 0 | 0 | 0 | 9.2 | 19.3 | 26.9 | 41.3[e] | 87.6[e] |

**Table 3-14. Two-Day Average[a] per Capita[b] Estimates of Direct[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Bottled (mL/kg-day) (Continued)**

[a] Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/.
[b] Includes all participants whether or not they ingested any water from the source during survey period.
[c] Direct water is defined as water ingested directly as a beverage; indirect water, defined as water added in the preparation of food or beverages, was not accounted for in the estimation of bottled water intake.
[d] Represents the percentage of individuals consuming at least once over the 2-day survey period.
[e] Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).
HNIS = Human Nutrition Information Service.
NCHS = National Center for Health Statistics.
SE = Standard error.

Source: U.S. EPA analysis of NHANES 2005−2010 data using http://fcid.foodrisk.org/.

**Table 3-15. Two-Day Average[a] per Capita[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Other Sources (mL/kg-day)**

| Population Group | Sample Size | Percent Consuming[d] | Mean | SE | Percentiles | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | Max |
| All ages | 24,673 | 33 | 4.6 | 0.4 | 0 | 0 | 0 | 0 | 0 | 3.5 | 15.0 | 24.5 | 53.3 | 343.1 |
| Age group | | | | | | | | | | | | | | |
| Birth to <1 month | 87 | 45 | 66.2 | 13.5 | 0[e] | 0[e] | 0[e] | 0 | 0 | 143.4 | 183.2[e] | 205.8[e] | 302.0[e] | 302.0[e] |
| 1 to <3 months | 233 | 50 | 62.6 | 7.0 | 0[e] | 0[e] | 0 | 0 | 0 | 122.0 | 171.0 | 194.7[e] | 230.7[e] | 343.1[e] |
| 3 to <6 months | 282 | 53 | 49.0 | 5.5 | 0[e] | 0[e] | 0 | 0 | 1.9 | 102.0 | 137.6 | 157.4[e] | 204.6[e] | 225.8[e] |
| 6 to <12 months | 588 | 49 | 31.0 | 2.7 | 0[e] | 0 | 0 | 0 | 0 | 63.0 | 96.9 | 119.3 | 154.8[e] | 239.7[e] |
| Birth to <1 year | 1,190 | 50 | 43.7 | 3.3 | 0[e] | 0 | 0 | 0 | 0 | 86.1 | 134.4 | 157.4 | 215.8[e] | 343.1[e] |
| 1 to <2 years | 728 | 37 | 6.9 | 1.0 | 0[e] | 0 | 0 | 0 | 0 | 8.2 | 23.8 | 30.7 | 74.8[e] | 130.3[e] |
| 2 to <3 years | 751 | 35 | 6.8 | 1.0 | 0[e] | 0 | 0 | 0 | 0 | 6.6 | 23.0 | 40.3 | 75.5[e] | 162.0[e] |
| 3 to <6 years | 1,418 | 36 | 4.5 | 0.5 | 0[e] | 0 | 0 | 0 | 0 | 4.8 | 14.9 | 24.2 | 44.1[e] | 164.9[e] |
| 6 to <11 years | 2,292 | 32 | 3.5 | 0.4 | 0 | 0 | 0 | 0 | 0 | 2.6 | 12.6 | 20.6 | 40.2 | 72.1[e] |
| 11 to <16 years | 2,551 | 39 | 3.5 | 0.3 | 0 | 0 | 0 | 0 | 0 | 3.5 | 12.3 | 19.4 | 33.7 | 81.1[e] |
| 16 to <21 years | 2,191 | 34 | 3.1 | 0.5 | 0 | 0 | 0 | 0 | 0 | 2.2 | 10.7 | 18.1 | 38.0 | 120.6[e] |
| 21 to <30 years | 2,082 | 30 | 2.6 | 0.4 | 0 | 0 | 0 | 0 | 0 | 1.3 | 8.5 | 13.7 | 36.6 | 94.1[e] |
| 30 to <40 years | 2,282 | 28 | 3.3 | 0.5 | 0 | 0 | 0 | 0 | 0 | 1.3 | 11.4 | 22.3 | 43.5 | 86.9[e] |
| 40 to <50 years | 2,378 | 33 | 4.7 | 0.5 | 0 | 0 | 0 | 0 | 0 | 4.4 | 17.4 | 26.9 | 47.4 | 98.0[e] |
| 50 to <60 years | 2,103 | 32 | 5.0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 4.8 | 19.1 | 27.5 | 52.0 | 83.6[e] |
| 60 to <70 years | 2,214 | 32 | 4.1 | 0.5 | 0 | 0 | 0 | 0 | 0 | 5.0 | 15.5 | 21.7 | 40.4 | 93.3[e] |
| 70 to <80 years | 1,578 | 36 | 5.2 | 0.5 | 0[e] | 0 | 0 | 0 | 0 | 7.5 | 20.3 | 24.9 | 40.6[e] | 61.3[e] |
| 80+ years | 915 | 28 | 3.7 | 0.5 | 0[e] | 0 | 0 | 0 | 0 | 4.5 | 14.1 | 19.9 | 28.7[e] | 53.6[e] |
| Birth to <2 years | 1,918 | 44 | 26.3 | 2.0 | 0[e] | 0 | 0 | 0 | 0 | 27.0 | 105.0 | 135.8 | 199.1[e] | 343.1[e] |
| 2 to <16 years | 7,012 | 36 | 4.0 | 0.3 | 0 | 0 | 0 | 0 | 0 | 3.6 | 13.5 | 21.9 | 43.0 | 164.9[e] |
| 16 to <70 years | 13,250 | 31 | 3.9 | 0.4 | 0 | 0 | 0 | 0 | 0 | 2.8 | 13.4 | 22.9 | 44.3 | 120.6[e] |
| 21 to <50 years | 6,742 | 31 | 3.6 | 0.4 | 0 | 0 | 0 | 0 | 0 | 2.1 | 12.0 | 22.2 | 44.3 | 98.0[e] |
| 50+ years | 6,810 | 32 | 4.7 | 0.4 | 0 | 0 | 0 | 0 | 0 | 5.3 | 17.5 | 24.6 | 44.2 | 93.3[e] |
| Race | | | | | | | | | | | | | | |
| Mexican American | 5,787 | 43 | 5.0 | 0.3 | 0 | 0 | 0 | 0 | 0 | 4.7 | 11.8 | 19.7 | 80.1 | 296.5[e] |
| Non-Hispanic black | 5,337 | 30 | 2.8 | 0.2 | 0 | 0 | 0 | 0 | 0 | 1.0 | 7.4 | 11.6 | 40.7 | 343.1[e] |
| Non-Hispanic white | 10,294 | 31 | 4.9 | 0.5 | 0 | 0 | 0 | 0 | 0 | 3.8 | 17.4 | 26.6 | 51.8 | 276.2[e] |
| Other Hispanic | 2,082 | 36 | 3.8 | 0.4 | 0 | 0 | 0 | 0 | 0 | 3.8 | 9.6 | 14.4 | 50.1 | 200.5[e] |
| Other race—including multiple | 1,173 | 32 | 5.0 | 0.6 | 0[e] | 0 | 0 | 0 | 0 | 4.3 | 16.3 | 25.5 | 55.8[e] | 237.8[e] |

**Table 3-15. Two-Day Average[a] per Capita[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Other Sources (mL/kg-day) (Continued)**

[a] Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/.
[b] Includes all participants whether or not they ingested any water from the source during survey period.
[c] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[d] Represents the percentage of individuals consuming at least once over the 2-day survey period.
[e] Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).
HNIS = Human Nutrition Information Service.
NCHS = National Center for Health Statistics.
SE = Standard error.

Source: U.S. EPA analysis of NHANES 2005−2010 data using http://fcid.foodrisk.org/.

**Table 3-16. Two-Day Average[a] per Capita[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: All Sources (mL/kg-day)**

| Population Group | Sample Size | Percent Consuming[d] | Mean | SE | Percentiles | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | Max |
| All ages | 24,673 | 99 | 20.2 | 0.3 | 0 | 2.0 | 4.2 | 9.1 | 16.4 | 26.4 | 39.3 | 49.1 | 83.3 | 343.1[e] |
| Age group | | | | | | | | | | | | | | |
| Birth to <1 month | 87 | 78 | 109.8 | 13.4 | 0[e] | 0[e] | 0[e] | 10.6 | 129.9 | 178.8 | 206.5[e] | 253.0[e] | 302.0[e] | 302.0[e] |
| 1 to <3 months | 233 | 70 | 89.2 | 5.3 | 0[e] | 0[e] | 0 | 0 | 108.2 | 140.4 | 187.7 | 203.9[e] | 267.2[e] | 343.1[e] |
| 3 to <6 months | 282 | 83 | 77.2 | 4.3 | 0[e] | 0[e] | 0 | 12.3 | 86.3 | 116.9 | 143.3 | 164.9[e] | 215.8[e] | 252.6[e] |
| 6 to <12 months | 588 | 98 | 64.8 | 2.4 | 0[e] | 2.6 | 7.5 | 26.6 | 66.1 | 96.2 | 122.6 | 138.2 | 167.6[e] | 239.7[e] |
| Birth to <1 year | 1,190 | 87 | 75.5 | 2.7 | 0[e] | 0 | 0 | 21.1 | 74.8 | 113.3 | 149.4 | 183.2 | 237.8[e] | 343.1[e] |
| 1 to <2 years | 728 | 98 | 26.4 | 1.1 | 0[e] | 1.5 | 4.5 | 13.1 | 22.0 | 34.2 | 53.5 | 69.4 | 86.2[e] | 216.4[e] |
| 2 to <3 years | 751 | 99 | 29.1 | 1.2 | 0[e] | 3.1 | 5.7 | 11.5 | 23.0 | 41.2 | 59.3 | 71.3 | 95.3[e] | 316.2[e] |
| 3 to <6 years | 1,418 | 99 | 22.6 | 0.7 | 0.1[e] | 2.6 | 4.8 | 10.0 | 18.7 | 31.1 | 44.0 | 53.6 | 85.9[e] | 164.9[e] |
| 6 to <11 years | 2,292 | 98 | 18.4 | 0.6 | 0 | 1.6 | 3.5 | 8.1 | 14.9 | 24.8 | 35.8 | 46.9 | 70.1 | 157.7[e] |
| 11 to <16 years | 2,551 | 98 | 13.5 | 0.6 | 0 | 0.5 | 1.5 | 5.2 | 10.5 | 17.8 | 28.5 | 38.3 | 61.9 | 81.9[e] |
| 16 to <21 years | 2,191 | 97 | 14.9 | 0.5 | 0 | 0.4 | 1.9 | 5.4 | 11.7 | 20.3 | 32.3 | 40.8 | 53.2 | 120.6[e] |
| 21 to <30 years | 2,082 | 98 | 19.1 | 0.7 | 0 | 1.5 | 3.5 | 7.9 | 15.9 | 25.0 | 39.6 | 49.0 | 67.3 | 112.0[e] |
| 30 to <40 years | 2,282 | 99 | 20.4 | 0.5 | 0.2 | 2.7 | 4.7 | 9.9 | 16.9 | 28.5 | 40.7 | 47.8 | 65.0 | 95.0[e] |
| 40 to <50 years | 2,378 | 99 | 21.1 | 0.6 | 0.3 | 2.8 | 5.3 | 10.4 | 18.4 | 28.1 | 39.8 | 48.1 | 72.3 | 178.8[e] |
| 50 to <60 years | 2,103 | 100 | 21.0 | 0.5 | 0.6 | 2.7 | 5.5 | 10.9 | 18.3 | 28.3 | 38.7 | 46.4 | 72.7 | 122.9[e] |
| 60 to <70 years | 2,214 | 100 | 19.3 | 0.5 | 1.1 | 4.3 | 6.1 | 10.6 | 16.9 | 25.4 | 35.3 | 41.8 | 56.5 | 120.7[e] |
| 70 to <80 years | 1,578 | 99 | 18.1 | 0.4 | 1.0[e] | 4.1 | 6.3 | 9.9 | 16.5 | 23.1 | 32.0 | 40.2 | 56.9[e] | 80.8[e] |
| 80+ years | 915 | 100 | 16.5 | 0.4 | 2.3[e] | 4.5 | 6.2 | 9.7 | 14.8 | 22.0 | 28.1 | 32.5 | 47.6[e] | 91.8[e] |
| Birth to <2 years | 1,918 | 92 | 52.2 | 1.9 | 0[e] | 0 | 1.5 | 14.8 | 31.4 | 80.1 | 127.2 | 152.4 | 213.9[e] | 343.1[e] |
| 2 to <16 years | 7,012 | 98 | 18.2 | 0.4 | 0 | 1.1 | 3.0 | 7.3 | 13.9 | 24.7 | 38.4 | 49.1 | 74.1 | 316.2[e] |
| 16 to <70 years | 13,250 | 99 | 19.7 | 0.3 | <0.05 | 2.2 | 4.5 | 9.5 | 16.9 | 26.8 | 38.7 | 46.4 | 67.4 | 178.8[e] |
| 21 to <50 years | 6,742 | 99 | 20.2 | 0.4 | 0.1 | 2.3 | 4.6 | 9.6 | 17.1 | 27.5 | 39.9 | 48.3 | 68.4 | 178.8[e] |
| 50+ years | 6,810 | 100 | 19.5 | 0.3 | 0.8 | 3.7 | 5.8 | 10.5 | 17.1 | 25.6 | 35.7 | 43.4 | 65.3 | 122.9[e] |
| Race | | | | | | | | | | | | | | |
| Mexican American | 5,787 | 99 | 19.6 | 0.3 | 0.1 | 2.1 | 3.9 | 8.1 | 14.7 | 24.2 | 38.0 | 50.5 | 108.1 | 296.5[e] |
| Non-Hispanic black | 5,337 | 98 | 16.2 | 0.3 | 0 | 1.4 | 2.9 | 6.4 | 12.3 | 20.7 | 31.5 | 40.2 | 86.6 | 343.1[e] |
| Non-Hispanic white | 10,294 | 99 | 20.7 | 0.4 | 0 | 2.0 | 4.5 | 9.7 | 17.3 | 27.3 | 40.0 | 49.1 | 79.8 | 284.4[e] |
| Other Hispanic | 2,082 | 99 | 20.0 | 0.7 | 0 | 2.7 | 4.1 | 8.3 | 14.6 | 25.5 | 39.0 | 51.3 | 112.0 | 316.2[e] |
| Other race—including multiple | 1,173 | 99 | 23.8 | 0.7 | 0.3[e] | 3.4 | 5.6 | 11.4 | 19.1 | 30.2 | 45.9 | 56.2 | 96.5[e] | 237.8[e] |

**Table 3-16. Two-Day Average[a] per Capita[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: All Sources (mL/kg-day) (Continued)**

| | |
|---|---|
| [a] | Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/. |
| [b] | Includes all participants whether or not they ingested any water from the source during survey period. |
| [c] | Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages. Does not include indirect consumption of bottled water. |
| [d] | Represents the percentage of individuals consuming at least once over the 2-day survey period. |
| [e] | Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993). |
| HNIS | = Human Nutrition Information Service. |
| NCHS | = National Center for Health Statistics. |
| SE | = Standard error. |
| Source: | U.S. EPA analysis of NHANES 2005−2010 data using http://fcid.foodrisk.org/. |

**Table 3-17. Two-Day Average[a] Consumer-Only[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Community Water (mL/day)**

| Population Group | Sample Size | Mean | SE | Percentiles | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | Max |
| All ages | 15,219 | 1,096 | 21 | 13 | 70 | 147 | 369 | 834 | 1,540 | 2,413 | 2,972 | 4,463 | 8,634[d] |
| Age group | | | | | | | | | | | | | |
| Birth to <1 month | 20 | 581 | 84 | 15[d] | 25[d] | 40[d] | 148[d] | 699 | 839[d] | 901[d] | 938[d] | 1,037[d] | 1,037[d] |
| 1 to <3 months | 45 | 785 | 47 | 105[d] | 148[d] | 489[d] | 658[d] | 804 | 958[d] | 1,177[d] | 1,224[d] | 1,403[d] | 1,403[d] |
| 3 to <6 months | 65 | 649 | 55 | 7[d] | 96[d] | 144[d] | 450[d] | 655 | 887[d] | 1,037[d] | 1,125[d] | 1,388[d] | 1,390[d] |
| 6 to <12 months | 244 | 554 | 31 | 12[d] | 37[d] | 69 | 201 | 587 | 823 | 993 | 1,104[d] | 1,324[d] | 1,797[d] |
| Birth to <1 year | 374 | 595 | 25 | 7[d] | 40[d] | 98 | 277 | 657 | 851 | 1,009 | 1,106[d] | 1,376[d] | 1,797[d] |
| 1 to <2 years | 394 | 245 | 15 | 7[d] | 15 | 28 | 85 | 209 | 306 | 524 | 658 | 842[d] | 2,619[d] |
| 2 to <3 years | 445 | 332 | 15 | 6[d] | 43 | 59 | 126 | 254 | 430 | 733 | 901 | 1,183[d] | 2,861[d] |
| 3 to <6 years | 860 | 338 | 15 | 7[d] | 33 | 71 | 139 | 274 | 477 | 683 | 836 | 1,282[d] | 2,179[d] |
| 6 to <11 years | 1,473 | 455 | 20 | 6[d] | 39 | 73 | 176 | 356 | 580 | 953 | 1,258 | 2,277[d] | 4,048[d] |
| 11 to <16 years | 1,449 | 562 | 38 | 7[d] | 31 | 68 | 160 | 361 | 726 | 1,315 | 1,761 | 2,773[d] | 5,120[d] |
| 16 to <21 years | 1,312 | 722 | 27 | 6[d] | 29 | 66 | 199 | 442 | 1,026 | 1,647 | 2,214 | 3,237[d] | 7,184[d] |
| 21 to <30 years | 1,318 | 1,183 | 52 | 11[d] | 59 | 136 | 377 | 877 | 1,628 | 2,645 | 3,407 | 5,271[d] | 7,504[d] |
| 30 to <40 years | 1,530 | 1,277 | 37 | 24[d] | 115 | 223 | 508 | 1,010 | 1,789 | 2,720 | 3,278 | 4,584[d] | 7,402[d] |
| 40 to <50 years | 1,532 | 1,356 | 50 | 18[d] | 129 | 281 | 593 | 1,083 | 1,911 | 2,708 | 3,374 | 4,776[d] | 7,041[d] |
| 50 to <60 years | 1,412 | 1,419 | 37 | 35[d] | 151 | 334 | 669 | 1,200 | 1,923 | 2,815 | 3,388 | 4,626[d] | 6,554[d] |
| 60 to <70 years | 1,453 | 1,394 | 43 | 63[d] | 213 | 370 | 710 | 1,214 | 1,890 | 2,602 | 3,187 | 4,123[d] | 8,634[d] |
| 70 to <80 years | 1,017 | 1,214 | 31 | 129[d] | 321 | 405 | 689 | 1,088 | 1,559 | 2,118 | 2,641 | 3,601[d] | 4,975[d] |
| 80+ years | 650 | 1,087 | 30 | 62[d] | 250 | 359 | 586 | 990 | 1,445 | 1,964 | 2,250 | 3,180[d] | 5,334[d] |
| Birth to <2 years | 768 | 388 | 18 | 7[d] | 15 | 40 | 134 | 281 | 641 | 864 | 999 | 1,288[d] | 2,619[d] |
| 2 to <16 years | 4,227 | 458 | 19 | 6 | 34 | 68 | 156 | 324 | 592 | 985 | 1,348 | 2,559 | 5,120[d] |
| 16 to <70 years | 8,557 | 1,269 | 25 | 15 | 103 | 205 | 503 | 1,024 | 1,784 | 2,645 | 3,250 | 4,773 | 8,634[d] |
| 21 to <50 years | 4,380 | 1,277 | 31 | 17 | 97 | 202 | 497 | 1,001 | 1,818 | 2,685 | 3,353 | 4,859 | 7,504[d] |
| 50+ years | 4,532 | 1,343 | 27 | 53 | 216 | 363 | 677 | 1,152 | 1,783 | 2,574 | 3,081 | 4,309 | 8,634[d] |
| Race | | | | | | | | | | | | | |
| Mexican American | 3,011 | 794 | 31 | 4 | 52 | 106 | 244 | 530 | 1,063 | 1,814 | 2,485 | 4,116 | 7,504[d] |
| Non-Hispanic black | 3,560 | 782 | 27 | 7 | 38 | 89 | 247 | 519 | 1,054 | 1,819 | 2,378 | 4,031 | 7,402[d] |
| Non-Hispanic white | 6,698 | 1,201 | 25 | 15 | 84 | 172 | 450 | 965 | 1,695 | 2,558 | 3,081 | 4,570 | 8,634[d] |
| Other Hispanic | 1,207 | 914 | 52 | 17[d] | 74 | 119 | 284 | 619 | 1,195 | 2,125 | 2,848 | 4,584[d] | 7,184[d] |
| Other race—including multiple | 743 | 1,085 | 67 | 20[d] | 89 | 172 | 410 | 789 | 1,532 | 2,246 | 2,990 | 5,143[d] | 7,018[d] |

**Table 3-17. Two-Day Average[a] Consumer-Only[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Community Water (mL/day) (Continued)**

[a] Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/.
[b] Excludes individuals who did not ingest water from the source during the survey period.
[c] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[d] Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).
HNIS = Human Nutrition Information Service.
NCHS = National Center for Health Statistics.
SE = Standard error.

Source: U.S. EPA analysis of NHANES 2005−2010 data using http://fcid.foodrisk.org/.

**Table 3-18. Two-Day Average[a] Consumer-Only[b] Estimates of Direct[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Bottled Water (mL/day)**

| Population Group | Sample Size | Mean | SE | Percentiles | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | Max |
| All ages | 11,309 | 736 | 15 | 37 | 89 | 119 | 250 | 500 | 984 | 1,666 | 2,133 | 3,435 | 8,834[d] |
| Age group | | | | | | | | | | | | | |
| Birth to <1 month | 16 | 38 | 17 | 3[d] | 3[d] | 3[d] | 3[d] | 30 | 44[d] | 104[d] | 155[d] | 296[d] | 296[d] |
| 1 to <3 months | 38 | 66 | 15 | 1[d] | 3[d] | 5[d] | 15[d] | 44 | 119[d] | 178[d] | 192[d] | 192[d] | 192[d] |
| 3 to <6 months | 79 | 61 | 6 | 4[d] | 15[d] | 15[d] | 30 | 44 | 89 | 119[d] | 133[d] | 178[d] | 178[d] |
| 6 to <12 months | 228 | 109 | 9 | 7[d] | 15[d] | 30 | 44 | 89 | 133 | 244 | 281[d] | 474[d] | 680[d] |
| Birth to <1 year | 361 | 93 | 7 | 3[d] | 7[d] | 15 | 30 | 59 | 119 | 207 | 252[d] | 385[d] | 680[d] |
| 1 to <2 years | 317 | 188 | 15 | 7[d] | 30[d] | 44 | 74 | 133 | 266 | 415 | 578[d] | 711[d] | 790[d] |
| 2 to <3 years | 332 | 273 | 26 | 15[d] | 40[d] | 52 | 74 | 193 | 333 | 548 | 711[d] | 1,341[d] | 4,205[d] |
| 3 to <6 years | 617 | 299 | 19 | 22[d] | 52 | 59 | 119 | 215 | 385 | 622 | 830 | 1,666[d] | 1,762[d] |
| 6 to <11 years | 1,036 | 374 | 18 | 37[d] | 59 | 89 | 148 | 250 | 466 | 770 | 1,067 | 2,001[d] | 4,717[d] |
| 11 to <16 years | 1,236 | 517 | 26 | 37[d] | 89 | 119 | 237 | 356 | 635 | 1,184 | 1,600 | 2,276[d] | 4,322[d] |
| 16 to <21 years | 1,111 | 753 | 37 | 96[d] | 148 | 193 | 296 | 555 | 992 | 1,500 | 1,995 | 3,140[d] | 5,810[d] |
| 21 to <30 years | 1,125 | 882 | 34 | 59[d] | 125 | 178 | 296 | 694 | 1,244 | 1,816 | 2,354 | 3,672[d] | 7,673[d] |
| 30 to <40 years | 1,244 | 903 | 36 | 52[d] | 119 | 178 | 296 | 681 | 1,228 | 1,935 | 2,481 | 4,001[d] | 6,636[d] |
| 40 to <50 years | 1,240 | 860 | 33 | 44[d] | 119 | 178 | 259 | 605 | 1,184 | 1,896 | 2,368 | 3,895[d] | 8,834[d] |
| 50 to <60 years | 991 | 818 | 33 | 59[d] | 119 | 178 | 296 | 593 | 1,067 | 1,896 | 2,250 | 3,826[d] | 4,513[d] |
| 60 to <70 years | 1,008 | 713 | 31 | 59[d] | 118 | 126 | 250 | 509 | 987 | 1,600 | 1,948 | 2,714[d] | 5,024[d] |
| 70 to <80 years | 507 | 644 | 34 | 22[d] | 82 | 119 | 237 | 444 | 918 | 1,422 | 1,894 | 2,664[d] | 3,228[d] |
| 80+ years | 184 | 577 | 53 | 15[d] | 52[d] | 82[d] | 178 | 385 | 770 | 1,225[d] | 1,822[d] | 2,844[d] | 6,213[d] |
| Birth to <2 years | 678 | 149 | 11 | 3[d] | 15 | 30 | 48 | 111 | 178 | 314 | 474 | 711[d] | 790[d] |
| 2 to <16 years | 3,221 | 410 | 13 | 30 | 59 | 83 | 156 | 280 | 500 | 859 | 1,250 | 2,132 | 4,717[d] |
| 16 to <70 years | 6,719 | 839 | 18 | 59 | 119 | 178 | 296 | 606 | 1,138 | 1,837 | 2,254 | 3,750 | 8,834[d] |
| 21 to <50 years | 3,609 | 881 | 22 | 52 | 119 | 178 | 296 | 652 | 1,185 | 1,896 | 2,370 | 3,895 | 8,834[d] |
| 50+ years | 2,690 | 748 | 19 | 44 | 96 | 133 | 250 | 518 | 1,000 | 1,697 | 2,137 | 3,111 | 6,213[d] |
| Race | | | | | | | | | | | | | |
| Mexican American | 3,349 | 717 | 27 | 30 | 74 | 119 | 237 | 487 | 975 | 1,658 | 2,004 | 3,256 | 6,213[d] |
| Non-Hispanic black | 2,598 | 757 | 28 | 40 | 89 | 125 | 250 | 500 | 1,000 | 1,685 | 2,281 | 3,986 | 6,634[d] |
| Non-Hispanic white | 3,681 | 732 | 18 | 37 | 89 | 125 | 250 | 500 | 974 | 1,658 | 2,081 | 3,507 | 8,834[d] |
| Other Hispanic | 1,120 | 793 | 44 | 30[d] | 74 | 119 | 237 | 509 | 1,067 | 1,895 | 2,495 | 3,254[d] | 7,673[d] |
| Other race—including multiple | 561 | 713 | 39 | 30[d] | 74 | 148 | 250 | 509 | 947 | 1,593 | 2,039 | 2,844[d] | 4,717[d] |

**Table 3-18. Two-Day Average[a] Consumer-Only[b] Estimates of Direct[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Bottled Water (mL/day) (Continued)**

[a] Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/.

[b] Excludes individuals who did not ingest water from the source during the survey period.

[c] Direct water is defined as water ingested directly as a beverage; indirect water, defined as water added in the preparation of food or beverages, was not accounted for in the estimation of bottled water intake.

[d] Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).

HNIS = Human Nutrition Information Service.
NCHS = National Center for Health Statistics.
SE = Standard error.

Source: U.S. EPA analysis of NHANES 2005−2010 data using http://fcid.foodrisk.org/.

**Table 3-19. Two-Day Average[a] Consumer-Only[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Other Sources (mL/day)**

| Population Group | Sample Size | Mean | SE | Percentiles | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | Max |
| All ages | 8,722 | 833 | 39 | 8 | 35 | 70 | 214 | 550 | 1,105 | 1,976 | 2,682 | 4,113 | 8,398[d] |
| Age group | | | | | | | | | | | | | |
| Birth to <1 month | 47 | 611 | 37 | 153[d] | 269[d] | 288[d] | 455[d] | 638 | 720[d] | 912[d] | 923[d] | 994[d] | 1,011[d] |
| 1 to <3 months | 134 | 704 | 26 | 14[d] | 161[d] | 296[d] | 551 | 710 | 856 | 1,055[d] | 1,122[d] | 1,184[d] | 1,489[d] |
| 3 to <6 months | 175 | 665 | 35 | 5[d] | 15[d] | 62[d] | 433 | 729 | 887 | 1,154[d] | 1,250[d] | 1,396[d] | 1,424[d] |
| 6 to <12 months | 328 | 564 | 22 | 1[d] | 17[d] | 51 | 268 | 590 | 807 | 1,048 | 1,182[d] | 1,359[d] | 1,486[d] |
| Birth to <1 year | 684 | 619 | 15 | 5[d] | 19 | 74 | 402 | 668 | 839 | 1,049 | 1,154 | 1,391[d] | 1,489[d] |
| 1 to <2 years | 310 | 209 | 19 | 2[d] | 12[d] | 28 | 80 | 144 | 286 | 472 | 642[d] | 917[d] | 1,485[d] |
| 2 to <3 years | 282 | 268 | 28 | 2[d] | 14[d] | 17 | 72 | 178 | 363 | 630 | 887[d] | 1,161[d] | 2,284[d] |
| 3 to <6 years | 525 | 231 | 14 | 6[d] | 17 | 27 | 69 | 138 | 282 | 532 | 721 | 1,141[d] | 4,698[d] |
| 6 to <11 years | 755 | 331 | 28 | 8[d] | 28 | 42 | 95 | 241 | 481 | 764 | 948 | 1,290[d] | 2,437[d] |
| 11 to <16 years | 994 | 513 | 32 | 6[d] | 17 | 40 | 115 | 328 | 705 | 1,181 | 1,526 | 2,885[d] | 3,911[d] |
| 16 to <21 years | 760 | 632 | 69 | 12[d] | 24 | 49 | 135 | 381 | 851 | 1,583 | 2,297 | 3,209[d] | 7,815[d] |
| 21 to <30 years | 682 | 640 | 70 | 7[d] | 30 | 50 | 160 | 404 | 766 | 1,428 | 2,445 | 3,750[d] | 8,127[d] |
| 30 to <40 years | 708 | 937 | 77 | 7[d] | 38 | 94 | 256 | 574 | 1,258 | 2,510 | 3,004 | 4,248[d] | 7,459[d] |
| 40 to <50 years | 805 | 1,117 | 75 | 17[d] | 52 | 119 | 390 | 785 | 1,535 | 2,414 | 3,330 | 4,696[d] | 8,398[d] |
| 50 to <60 years | 666 | 1,260 | 82 | 9[d] | 139 | 207 | 498 | 928 | 1,718 | 2,820 | 3,726 | 5,339[d] | 7,600[d] |
| 60 to <70 years | 742 | 1,042 | 57 | 29[d] | 126 | 214 | 434 | 836 | 1,335 | 2,155 | 2,800 | 4,160[d] | 7,447[d] |
| 70 to <80 years | 546 | 1,116 | 38 | 22[d] | 117 | 257 | 506 | 996 | 1,570 | 2,247 | 2,443 | 3,210[d] | 5,316[d] |
| 80+ years | 263 | 900 | 37 | 59[d] | 196[d] | 282 | 533 | 808 | 1,118 | 1,635 | 1,836[d] | 2,330[d] | 3,917[d] |
| Birth to <2 years | 994 | 454 | 16 | 5[d] | 15 | 44 | 124 | 392 | 725 | 924 | 1,102 | 1,359[d] | 1,489[d] |
| 2 to <16 years | 2,556 | 380 | 18 | 6 | 20 | 39 | 93 | 228 | 515 | 917 | 1,165 | 2,347 | 4,698[d] |
| 16 to <70 years | 4,363 | 969 | 49 | 10 | 43 | 93 | 284 | 654 | 1,289 | 2,297 | 2,969 | 4,335 | 8,398[d] |
| 21 to <50 years | 2,195 | 919 | 63 | 9 | 37 | 80 | 252 | 595 | 1,229 | 2,238 | 2,901 | 4,310 | 8,398[d] |
| 50+ years | 2,217 | 1,138 | 41 | 22 | 132 | 230 | 486 | 883 | 1,501 | 2,321 | 2,958 | 4,645 | 7,600[d] |
| Race | | | | | | | | | | | | | |
| Mexican American | 2,620 | 467 | 18 | 4 | 26 | 52 | 133 | 308 | 596 | 993 | 1,348 | 3,132 | 5,036[d] |
| Non-Hispanic black | 1,570 | 429 | 21 | 4[d] | 17 | 34 | 97 | 292 | 568 | 896 | 1,255 | 2,663[d] | 4,911[d] |
| Non-Hispanic white | 3,307 | 1,010 | 49 | 10 | 43 | 89 | 293 | 733 | 1,368 | 2,303 | 2,913 | 4,310 | 8,398[d] |
| Other Hispanic | 827 | 460 | 27 | 9[d] | 38 | 75 | 144 | 332 | 637 | 944 | 1,210 | 2,652[d] | 3,680[d] |
| Other race—including multiple | 398 | 781 | 62 | 18[d] | 54 | 89 | 304 | 516 | 1,020 | 1,772 | 2,204 | 3,725[d] | 4,562[d] |

**Table 3-19. Two-Day Average[a] Consumer-Only[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Other Sources (mL/day) (Continued)**

[a] Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/.
[b] Excludes individuals who did not ingest water from the source during the survey period.
[c] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[d] Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).
HNIS = Human Nutrition Information Service.
NCHS = National Center for Health Statistics.
SE = Standard error.

Source: U.S. EPA analysis of NHANES 2005−2010 data using http://fcid.foodrisk.org/.

**Table 3-20. Two-Day Average[a] Consumer-Only[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: All Sources (mL/day)**

| Population Group | Sample Size | Mean | SE | Percentiles | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | Max |
| All ages | 24,299 | 1,325 | 20 | 29 | 130 | 247 | 544 | 1,076 | 1,843 | 2,715 | 3,306 | 4,773 | 10,280[d] |
| Age group | | | | | | | | | | | | | |
| Birth to <1 month | 68 | 597 | 47 | 30[d] | 40[d] | 87[d] | 434[d] | 685 | 781[d] | 924[d] | 953[d] | 1,144[d] | 1,234[d] |
| 1 to <3 months | 182 | 725 | 27 | 14[d] | 148[d] | 261[d] | 590 | 734 | 902 | 1,090[d] | 1,154[d] | 1,390[d] | 1,489[d] |
| 3 to <6 months | 243 | 666 | 28 | 5[d] | 15[d] | 125 | 449 | 714 | 894 | 1,122 | 1,251[d] | 1,391[d] | 1,456[d] |
| 6 to <12 months | 577 | 590 | 20 | 7[d] | 44 | 84 | 276 | 629 | 847 | 1,032 | 1,182 | 1,383[d] | 1,797[d] |
| Birth to <1 year | 1,070 | 628 | 15 | 7[d] | 44 | 121 | 373 | 671 | 864 | 1,058 | 1,177 | 1,390[d] | 1,797[d] |
| 1 to <2 years | 714 | 300 | 12 | 7[d] | 37 | 59 | 149 | 250 | 378 | 633 | 768 | 934[d] | 2,619[d] |
| 2 to <3 years | 741 | 408 | 17 | 14[d] | 53 | 78 | 166 | 330 | 563 | 837 | 1,001 | 1,317[d] | 4,205[d] |
| 3 to <6 years | 1,405 | 416 | 12 | 13[d] | 54 | 92 | 187 | 339 | 569 | 818 | 993 | 1,495[d] | 4,698[d] |
| 6 to <11 years | 2,263 | 565 | 17 | 12 | 61 | 123 | 250 | 476 | 754 | 1,110 | 1,389 | 2,305 | 5,473[d] |
| 11 to <16 years | 2,504 | 767 | 30 | 12 | 59 | 119 | 317 | 597 | 1,016 | 1,590 | 2,248 | 3,402 | 5,120[d] |
| 16 to <21 years | 2,129 | 1,068 | 36 | 14 | 89 | 198 | 399 | 907 | 1,487 | 2,218 | 2,808 | 3,792 | 7,815[d] |
| 21 to <30 years | 2,052 | 1,459 | 48 | 31 | 168 | 310 | 635 | 1,229 | 1,953 | 2,894 | 3,606 | 5,271 | 8,325[d] |
| 30 to <40 years | 2,262 | 1,642 | 40 | 46 | 247 | 400 | 798 | 1,407 | 2,261 | 3,149 | 3,859 | 5,135 | 7,459[d] |
| 40 to <50 years | 2,369 | 1,688 | 46 | 48 | 269 | 450 | 874 | 1,478 | 2,275 | 3,156 | 3,837 | 5,091 | 10,280[d] |
| 50 to <60 years | 2,095 | 1,705 | 38 | 69 | 262 | 490 | 919 | 1,509 | 2,247 | 3,065 | 3,925 | 5,349 | 7,600[d] |
| 60 to <70 years | 2,211 | 1,552 | 37 | 118 | 370 | 531 | 893 | 1,366 | 2,082 | 2,752 | 3,205 | 4,160 | 8,634[d] |
| 70 to <80 years | 1,570 | 1,367 | 29 | 159[d] | 377 | 496 | 845 | 1,275 | 1,735 | 2,366 | 2,748 | 3,619[d] | 5,316[d] |
| 80+ years | 914 | 1,142 | 26 | 170[d] | 318 | 429 | 698 | 1,007 | 1,493 | 1,953 | 2,296 | 3,236[d] | 7,054[d] |
| Birth to <2 years | 1,784 | 464 | 12 | 7[d] | 40 | 74 | 193 | 374 | 725 | 917 | 1,070 | 1,359[d] | 2,619[d] |
| 2 to <16 years | 6,913 | 597 | 15 | 12 | 57 | 109 | 241 | 465 | 775 | 1,213 | 1,589 | 2,773 | 5,473[d] |
| 16 to <70 years | 13,118 | 1,564 | 25 | 43 | 220 | 370 | 770 | 1,347 | 2,121 | 2,972 | 3,643 | 5,135 | 10,280[d] |
| 21 to <50 years | 6,683 | 1,604 | 33 | 40 | 229 | 382 | 767 | 1,380 | 2,183 | 3,092 | 3,780 | 5,167 | 10,280[d] |
| 50+ years | 6,790 | 1,545 | 25 | 115 | 327 | 496 | 859 | 1,357 | 2,018 | 2,798 | 3,363 | 4,689 | 8,634[d] |
| Race | | | | | | | | | | | | | |
| Mexican American | 5,725 | 1,070 | 27 | 22 | 108 | 195 | 396 | 813 | 1,463 | 2,250 | 2,876 | 4,490 | 7,504[d] |
| Non-Hispanic black | 5,246 | 1,052 | 25 | 22 | 106 | 192 | 414 | 809 | 1,419 | 2,261 | 2,804 | 4,393 | 7,519[d] |
| Non-Hispanic white | 10,116 | 1,422 | 26 | 29 | 141 | 274 | 615 | 1,207 | 1,974 | 2,837 | 3,421 | 4,865 | 10,280[d] |
| Other Hispanic | 2,058 | 1,178 | 44 | 33 | 119 | 202 | 442 | 897 | 1,610 | 2,538 | 3,307 | 4,584 | 8,325[d] |
| Other race—including multiple | 1,154 | 1,332 | 48 | 53[d] | 178 | 283 | 580 | 1,124 | 1,834 | 2,656 | 3,278 | 4,397[d] | 7,018[d] |

**Table 3-20. Two-Day Average[a] Consumer-Only[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: All Sources (mL/day) (Continued)**

| | |
|---|---|
| [a] | Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/. |
| [b] | Excludes individuals who did not ingest water from the source during the survey period. |
| [c] | Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages. Does not include indirect consumption of bottled water. |
| [d] | Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993). |
| HNIS | = Human Nutrition Information Service. |
| NCHS | = National Center for Health Statistics. |
| SE | = Standard error. |
| Source: | U.S. EPA analysis of NHANES 2005−2010 data using http://fcid.foodrisk.org/. |

**Table 3-21. Two-Day Average[a] Consumer-Only[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Community Water (mL/kg-day)**

| Population Group | Sample Size | Mean | SE | Percentiles | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | Max |
| All ages | 15,219 | 16.6 | 0.3 | 0.2 | 1.2 | 2.6 | 6.3 | 12.8 | 22.1 | 33.8 | 43.9 | 71.1 | 267.5[d] |
| Age group | | | | | | | | | | | | | |
| Birth to <1 month | 20 | 132.8 | 20.0 | 3.5[d] | 4.4[d] | 11.2[d] | 21.1[d] | 151.9 | 190.5[d] | 219.7[d] | 224.0[d] | 253.0[d] | 253.0[d] |
| 1 to <3 months | 45 | 136.4 | 8.6 | 22.3[d] | 26.4[d] | 72.9[d] | 111.6[d] | 134.0 | 163.7[d] | 192.2[d] | 267.2[d] | 267.5[d] | 267.5[d] |
| 3 to <6 months | 65 | 92.9 | 8.5 | 1.0[d] | 12.0[d] | 22.8[d] | 64.4[d] | 91.0 | 116.8[d] | 143.3[d] | 158.4[d] | 252.6[d] | 252.6[d] |
| 6 to <12 months | 244 | 62.3 | 3.7 | 1.2[d] | 4.4[d] | 7.8 | 23.0 | 63.9 | 96.2 | 113.3 | 133.0[d] | 167.6[d] | 213.9[d] |
| Birth to <1 year | 374 | 79.0 | 4.2 | 1.0[d] | 4.8[d] | 10.6 | 33.5 | 78.5 | 111.6 | 142.7 | 174.0[d] | 252.6[d] | 267.5[d] |
| 1 to <2 years | 394 | 22.1 | 1.4 | 0.6[d] | 1.4 | 2.3 | 7.9 | 18.5 | 28.7 | 48.7 | 57.3 | 84.5[d] | 216.4[d] |
| 2 to <3 years | 445 | 23.9 | 1.1 | 0.4[d] | 3.1 | 4.0 | 9.2 | 17.5 | 32.7 | 51.4 | 66.6 | 83.3[d] | 227.1[d] |
| 3 to <6 years | 860 | 18.7 | 0.8 | 0.3[d] | 1.7 | 4.0 | 7.5 | 14.4 | 26.2 | 38.8 | 45.2 | 67.3[d] | 126.6[d] |
| 6 to <11 years | 1,473 | 15.2 | 0.7 | 0.2[d] | 1.2 | 2.5 | 5.6 | 11.5 | 20.3 | 31.3 | 40.8 | 69.5[d] | 157.4[d] |
| 11 to <16 years | 1,449 | 10.4 | 0.8 | 0.1[d] | 0.5 | 1.1 | 2.9 | 6.8 | 13.1 | 24.7 | 31.1 | 62.2[d] | 81.9[d] |
| 16 to <21 years | 1,312 | 10.2 | 0.4 | 0.1[d] | 0.3 | 0.9 | 2.8 | 6.2 | 14.9 | 24.6 | 31.1 | 50.5[d] | 82.0[d] |
| 21 to <30 years | 1,318 | 15.9 | 0.8 | 0.1[d] | 0.7 | 1.7 | 5.2 | 11.7 | 21.5 | 34.4 | 46.9 | 67.1[d] | 99.9[d] |
| 30 to <40 years | 1,530 | 15.8 | 0.5 | 0.3[d] | 1.4 | 2.8 | 6.2 | 12.4 | 22.2 | 33.4 | 43.6 | 58.7[d] | 91.9[d] |
| 40 to <50 years | 1,532 | 17.2 | 0.6 | 0.2[d] | 1.6 | 3.1 | 7.2 | 13.5 | 23.5 | 35.6 | 43.3 | 64.8[d] | 110.1[d] |
| 50 to <60 years | 1,412 | 17.6 | 0.5 | 0.3[d] | 1.8 | 3.8 | 8.2 | 14.9 | 24.1 | 34.4 | 41.8 | 65.3[d] | 103.4[d] |
| 60 to <70 years | 1,453 | 17.3 | 0.6 | 0.6[d] | 2.5 | 4.5 | 8.7 | 14.8 | 22.9 | 33.3 | 39.8 | 55.4[d] | 120.7[d] |
| 70 to <80 years | 1,017 | 16.3 | 0.5 | 1.3[d] | 3.7 | 5.2 | 8.4 | 14.2 | 20.9 | 28.7 | 37.0 | 59.4[d] | 80.8[d] |
| 80+ years | 650 | 15.6 | 0.5 | 1.2[d] | 3.6 | 5.2 | 8.1 | 14.1 | 21.2 | 28.1 | 32.7 | 45.7[d] | 64.8[d] |
| Birth to <2 years | 768 | 45.4 | 2.5 | 0.7[d] | 1.5 | 3.7 | 12.7 | 25.1 | 69.4 | 112.9 | 139.6 | 193.2[d] | 267.5[d] |
| 2 to <16 years | 4,227 | 14.9 | 0.4 | 0.2 | 1.0 | 1.9 | 4.9 | 10.7 | 20.0 | 32.6 | 44.0 | 70.3 | 227.1[d] |
| 16 to <70 years | 8,557 | 16.1 | 0.3 | 0.2 | 1.2 | 2.6 | 6.3 | 12.9 | 22.3 | 33.5 | 42.5 | 64.1 | 120.7[d] |
| 21 to <50 years | 4,380 | 16.3 | 0.4 | 0.2 | 1.2 | 2.6 | 6.2 | 12.5 | 22.6 | 34.7 | 43.9 | 64.8 | 110.1[d] |
| 50+ years | 4,532 | 17.1 | 0.4 | 0.6 | 2.5 | 4.4 | 8.4 | 14.7 | 22.8 | 32.5 | 39.6 | 58.0 | 120.7[d] |
| Race | | | | | | | | | | | | | |
| Mexican American | 3,011 | 13.6 | 0.5 | 0.1 | 1.2 | 2.1 | 4.5 | 9.4 | 17.4 | 28.7 | 38.9 | 73.1 | 244.4[d] |
| Non-Hispanic black | 3,560 | 12.0 | 0.4 | 0.1 | 0.6 | 1.5 | 3.7 | 8.3 | 15.5 | 25.8 | 33.5 | 61.0 | 267.5[d] |
| Non-Hispanic white | 6,698 | 17.6 | 0.4 | 0.3 | 1.5 | 3.0 | 7.2 | 14.2 | 23.7 | 35.1 | 45.1 | 69.8 | 252.6[d] |
| Other Hispanic | 1,207 | 14.6 | 0.5 | 0.4[d] | 1.4 | 2.3 | 5.7 | 10.8 | 18.5 | 29.8 | 41.0 | 65.8[d] | 224.0[d] |
| Other race—including multiple | 743 | 19.1 | 1.0 | 0.3[d] | 1.8 | 3.5 | 7.8 | 14.7 | 24.5 | 38.0 | 51.3 | 84.7[d] | 227.1[d] |

**Table 3-21. Two-Day Average[a] Consumer-Only[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Community Water (mL/kg-day) (Continued)**

[a] Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/.
[b] Excludes individuals who did not ingest water from the source during the survey period.
[c] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[d] Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).
HNIS = Human Nutrition Information Service.
NCHS = National Center for Health Statistics.
SE = Standard error.

Source: U.S. EPA analysis of NHANES 2005−2010 data using http://fcid.foodrisk.org/.

**Table 3-22. Two-Day Average[a] Consumer-Only[b] Estimates of Direct[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Bottled Water (mL/kg-day)**

| Population Group | Sample Size | Mean | SE | Percentiles | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | Max |
| All ages | 11,309 | 11.0 | 0.2 | 0.7 | 1.6 | 2.2 | 3.8 | 7.8 | 14.5 | 23.4 | 30.3 | 50.3 | 316.2[d] |
| Age group | | | | | | | | | | | | | |
| Birth to <1 month | 16 | 8.4 | 3.6 | 0.7[d] | 0.7[d] | 0.7[d] | 0.7[d] | 5.6 | 10.8[d] | 22.5[d] | 31.1[d] | 63.0[d] | 63.0[d] |
| 1 to <3 months | 38 | 11.1 | 2.4 | 0.2[d] | 0.4[d] | 0.9[d] | 2.4[d] | 6.7 | 18.8[d] | 29.6[d] | 30.6[d] | 31.5[d] | 31.5[d] |
| 3 to <6 months | 79 | 8.3 | 0.8 | 0.5[d] | 2.2[d] | 2.2[d] | 3.7 | 6.6 | 12.3 | 16.0[d] | 19.3[d] | 26.1[d] | 28.2[d] |
| 6 to <12 months | 228 | 11.8 | 1.0 | 0.9[d] | 1.9[d] | 2.8 | 4.8 | 9.2 | 14.7 | 25.2 | 32.3[d] | 46.9[d] | 71.5[d] |
| Birth to <1 year | 361 | 11.0 | 0.7 | 0.4[d] | 1.4[d] | 2.2 | 4.2 | 8.1 | 14.1 | 25.2 | 30.6[d] | 46.9[d] | 71.5[d] |
| 1 to <2 years | 317 | 16.8 | 1.2 | 0.7[d] | 3.1[d] | 3.8 | 6.0 | 12.7 | 24.1 | 39.5 | 48.4[d] | 66.7[d] | 78.5[d] |
| 2 to <3 years | 332 | 19.7 | 1.9 | 1.0[d] | 3.1[d] | 3.6 | 5.3 | 13.8 | 23.4 | 41.3 | 52.1[d] | 96.9[d] | 316.2[d] |
| 3 to <6 years | 617 | 16.5 | 1.0 | 1.2[d] | 2.7 | 3.6 | 6.1 | 10.9 | 21.3 | 37.0 | 43.7 | 83.4[d] | 105.8[d] |
| 6 to <11 years | 1,036 | 12.0 | 0.5 | 1.1[d] | 2.2 | 2.8 | 4.7 | 8.7 | 14.8 | 24.5 | 34.4 | 61.5[d] | 114.5[d] |
| 11 to <16 years | 1,236 | 9.2 | 0.4 | 0.6[d] | 1.4 | 2.4 | 4.0 | 6.7 | 11.6 | 20.0 | 25.4 | 35.8[d] | 66.8[d] |
| 16 to <21 years | 1,111 | 11.1 | 0.6 | 1.3[d] | 2.1 | 2.7 | 4.0 | 8.3 | 15.0 | 23.4 | 29.6 | 50.1[d] | 106.4[d] |
| 21 to <30 years | 1,125 | 11.5 | 0.5 | 1.0[d] | 1.8 | 2.3 | 4.2 | 8.8 | 15.6 | 24.5 | 30.4 | 45.5[d] | 103.3[d] |
| 30 to <40 years | 1,244 | 11.3 | 0.5 | 0.7[d] | 1.6 | 2.2 | 3.8 | 8.4 | 15.1 | 24.2 | 33.2 | 49.4[d] | 84.1[d] |
| 40 to <50 years | 1,240 | 10.7 | 0.5 | 0.7[d] | 1.6 | 2.1 | 3.4 | 7.9 | 14.2 | 22.6 | 29.6 | 45.8[d] | 166.7[d] |
| 50 to <60 years | 991 | 9.9 | 0.4 | 0.7[d] | 1.4 | 1.9 | 3.3 | 7.3 | 13.3 | 21.4 | 28.2 | 46.0[d] | 75.2[d] |
| 60 to <70 years | 1,008 | 8.9 | 0.4 | 0.9[d] | 1.3 | 1.8 | 3.1 | 6.3 | 12.5 | 20.3 | 23.3 | 37.0[d] | 65.8[d] |
| 70 to <80 years | 507 | 8.5 | 0.5 | 0.3[d] | 1.1 | 1.4 | 2.9 | 5.9 | 11.9 | 19.9 | 25.8 | 30.8[d] | 48.1[d] |
| 80+ years | 184 | 8.4 | 0.8 | 0.2[d] | 0.9[d] | 1.0[d] | 2.4 | 6.2 | 11.1 | 17.6[d] | 23.0[d] | 45.4[d] | 80.9[d] |
| Birth to <2 years | 678 | 14.4 | 0.9 | 0.7[d] | 2.2 | 3.1 | 5.2 | 10.6 | 19.8 | 31.6 | 40.9 | 54.1[d] | 78.5[d] |
| 2 to <16 years | 3,221 | 12.3 | 0.4 | 0.8 | 1.9 | 2.8 | 4.5 | 8.3 | 15.5 | 25.8 | 35.7 | 61.5 | 316.2[d] |
| 16 to <70 years | 6,719 | 10.7 | 0.3 | 0.7 | 1.6 | 2.2 | 3.7 | 7.8 | 14.4 | 22.7 | 29.0 | 46.0 | 166.7[d] |
| 21 to <50 years | 3,609 | 11.2 | 0.3 | 0.7 | 1.6 | 2.2 | 3.8 | 8.3 | 15.0 | 23.7 | 31.0 | 46.4 | 166.7[d] |
| 50+ years | 2,690 | 9.3 | 0.3 | 0.6 | 1.2 | 1.8 | 3.1 | 6.6 | 12.8 | 20.9 | 26.2 | 42.3 | 80.9[d] |
| Race | | | | | | | | | | | | | |
| Mexican American | 3,349 | 12.0 | 0.3 | 0.9 | 1.7 | 2.4 | 4.5 | 9.1 | 15.8 | 24.3 | 31.7 | 55.1 | 114.5[d] |
| Non-Hispanic black | 2,598 | 10.6 | 0.3 | 0.8 | 1.7 | 2.3 | 3.8 | 7.6 | 14.1 | 23.3 | 29.6 | 47.9 | 84.2[d] |
| Non-Hispanic white | 3,681 | 10.5 | 0.3 | 0.7 | 1.5 | 2.1 | 3.6 | 7.5 | 14.0 | 22.3 | 29.0 | 48.5 | 166.7[d] |
| Other Hispanic | 1,120 | 13.1 | 0.8 | 1.1[d] | 1.7 | 2.2 | 4.3 | 8.6 | 17.0 | 29.1 | 36.6 | 69.4[d] | 316.2[d] |
| Other race—including multiple | 561 | 12.2 | 0.6 | 0.7[d] | 2.0 | 2.8 | 4.5 | 9.3 | 16.7 | 27.7 | 31.4 | 43.7[d] | 87.6[d] |

**Table 3-22. Two-Day Average[a] Consumer-Only[b] Estimates of Direct[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Bottled Water (mL/kg-day) (Continued)**

[a] Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/.

[b] Excludes individuals who did not ingest water from the source during the survey period.

[c] Direct water is defined as water ingested directly as a beverage; indirect water, defined as water added in the preparation of food or beverages, was not accounted for in the estimation of bottled water intake.

[d] Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).

HNIS = Human Nutrition Information Service.
NCHS = National Center for Health Statistics.
SE = Standard error.

Source: U.S. EPA analysis of NHANES 2005−2010 data using http://fcid.foodrisk.org/.

**Table 3-23. Two-Day Average[a] Consumer-Only[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Other Sources (mL/kg-day)**

| Population Group | Sample Size | Mean | SE | Percentiles | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | Max |
| All ages | 8,722 | 14.1 | 0.5 | 0.1 | 0.6 | 1.3 | 3.8 | 8.8 | 17.8 | 30.3 | 42.9 | 99.4 | 343.1 |
| Age group | | | | | | | | | | | | | |
| Birth to <1 month | 47 | 147.9 | 12.5 | 34.9[d] | 51.6[d] | 66.5[d] | 99.0[d] | 148.4 | 183.2[d] | 205.8[d] | 296.5[d] | 302.0[d] | 302.0[d] |
| 1 to <3 months | 134 | 125.5 | 5.2 | 5.2[d] | 26.9[d] | 54.7[d] | 102.0 | 122.0 | 154.2 | 194.7[d] | 218.4[d] | 237.8[d] | 343.1[d] |
| 3 to <6 months | 175 | 91.9 | 5.2 | 0.6[d] | 1.9[d] | 8.9[d] | 54.8 | 98.5 | 123.3 | 157.4[d] | 176.3[d] | 215.8[d] | 225.8[d] |
| 6 to <12 months | 328 | 63.8 | 2.8 | 0.1[d] | 1.8[d] | 6.1 | 29.0 | 63.8 | 89.7 | 119.3 | 140.8[d] | 167.2[d] | 239.7[d] |
| Birth to <1 year | 684 | 88.0 | 3.2 | 0.6[d] | 2.6 | 8.4 | 49.2 | 86.5 | 120.9 | 157.4 | 188.3 | 237.8[d] | 343.1[d] |
| 1 to <2 years | 310 | 18.6 | 1.8 | 0.2[d] | 1.1[d] | 2.7 | 5.9 | 13.4 | 24.2 | 39.4 | 58.4[d] | 77.0[d] | 130.3[d] |
| 2 to <3 years | 282 | 19.6 | 2.1 | 0.2[d] | 1.1[d] | 1.5 | 5.3 | 12.7 | 26.1 | 48.2 | 63.5[d] | 81.9[d] | 162.0[d] |
| 3 to <6 years | 525 | 12.3 | 0.8 | 0.3[d] | 1.1 | 1.7 | 3.9 | 8.1 | 15.9 | 26.1 | 33.9 | 67.2[d] | 164.9[d] |
| 6 to <11 years | 755 | 11.2 | 1.0 | 0.3[d] | 0.9 | 1.5 | 3.2 | 7.6 | 15.1 | 25.3 | 35.9 | 53.6[d] | 72.1[d] |
| 11 to <16 years | 994 | 8.9 | 0.5 | 0.1[d] | 0.3 | 0.7 | 2.0 | 5.9 | 12.4 | 21.7 | 27.0 | 45.7[d] | 81.1[d] |
| 16 to <21 years | 760 | 9.1 | 0.9 | 0.1[d] | 0.4 | 0.7 | 2.0 | 5.5 | 12.5 | 22.9 | 30.0 | 45.2[d] | 120.6[d] |
| 21 to <30 years | 682 | 8.6 | 1.0 | 0.1[d] | 0.3 | 0.6 | 2.0 | 5.5 | 10.9 | 21.1 | 30.5 | 48.3[d] | 94.1[d] |
| 30 to <40 years | 708 | 11.8 | 1.0 | 0.1[d] | 0.4 | 1.1 | 3.0 | 7.4 | 16.0 | 30.3 | 37.5 | 55.0[d] | 86.9[d] |
| 40 to <50 years | 805 | 14.0 | 1.0 | 0.2[d] | 0.6 | 1.6 | 4.4 | 10.0 | 20.1 | 31.1 | 41.6 | 56.7[d] | 98.0[d] |
| 50 to <60 years | 666 | 15.7 | 1.0 | 0.1[d] | 1.8 | 2.8 | 5.6 | 11.0 | 21.7 | 32.9 | 44.3 | 72.7[d] | 83.6[d] |
| 60 to <70 years | 742 | 13.0 | 0.8 | 0.3[d] | 1.5 | 2.7 | 5.5 | 19.7 | 17.6 | 25.7 | 35.5 | 55.0[d] | 93.3[d] |
| 70 to <80 years | 546 | 14.7 | 0.8 | 0.2[d] | 1.3 | 3.2 | 6.5 | 12.6 | 21.0 | 28.8 | 33.3 | 46.8[d] | 61.3[d] |
| 80+ years | 263 | 13.2 | 0.5 | 0.8[d] | 2.6[d] | 4.5 | 7.5 | 12.6 | 16.2 | 24.3 | 28.1[d] | 34.9[d] | 53.6[d] |
| Birth to <2 years | 994 | 60.1 | 2.9 | 0.5[d] | 1.8 | 3.9 | 11.6 | 40.2 | 99.0 | 140.4 | 163.9 | 218.4[d] | 343.1[d] |
| 2 to <16 years | 2,556 | 11.1 | 0.6 | 0.1 | 0.6 | 1.2 | 3.0 | 7.6 | 14.9 | 25.2 | 34.9 | 58.3 | 164.9[d] |
| 16 to <70 years | 4,363 | 12.3 | 0.7 | 0.1 | 0.5 | 1.3 | 3.6 | 8.4 | 16.9 | 28.8 | 37.8 | 55.4 | 120.6[d] |
| 21 to <50 years | 2,195 | 11.7 | 0.8 | 0.1 | 0.5 | 1.0 | 3.1 | 7.8 | 16.0 | 28.5 | 36.9 | 54.9 | 98.0[d] |
| 50+ years | 2,217 | 14.5 | 0.5 | 0.2 | 1.6 | 2.8 | 5.7 | 11.2 | 20.0 | 29.8 | 38.4 | 60.6 | 93.3[d] |
| Race | | | | | | | | | | | | | |
| Mexican American | 2,620 | 11.6 | 0.5 | 0.1 | 0.6 | 1.1 | 2.7 | 5.7 | 11.3 | 22.1 | 38.9 | 127.0 | 296.5[d] |
| Non-Hispanic black | 1,570 | 9.5 | 0.6 | 0.1[d] | 0.3 | 0.5 | 1.7 | 4.5 | 9.3 | 15.6 | 27.7 | 135.1[d] | 343.1[d] |
| Non-Hispanic white | 3,307 | 15.6 | 0.7 | 0.2 | 0.7 | 1.6 | 4.7 | 11.1 | 20.8 | 33.0 | 44.3 | 86.3 | 276.2[d] |
| Other Hispanic | 827 | 10.6 | 0.8 | 0.2[d] | 0.6 | 1.3 | 3.2 | 6.1 | 10.2 | 19.7 | 30.7 | 119.8[d] | 200.5[d] |
| Other Race—including multiple | 398 | 15.7 | 1.0 | 0.2[d] | 1.3 | 2.5 | 4.8 | 9.4 | 20.6 | 29.2 | 44.4 | 115.8[d] | 237.8[d] |

**Table 3-23. Two-Day Average[a] Consumer-Only[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: Other Sources (mL/kg-day) (Continued)**

[a] Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/.
[b] Excludes individuals who did not ingest water from the source during the survey period.
[c] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[d] Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).
HNIS = Human Nutrition Information Service.
NCHS = National Center for Health Statistics.
SE = Standard error.

Source: U.S. EPA analysis of NHANES 2005−2010 data using http://fcid.foodrisk.org/.

**Table 3-24. Two-Day Average[a] Consumer-Only[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: All Sources (mL/kg-day)**

| Population Group | Sample Size | Mean | SE | Percentiles | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | Max |
| All ages | 24,299 | 20.5 | 0.3 | 0.6 | 2.6 | 4.6 | 9.3 | 16.6 | 26.6 | 39.5 | 49.5 | 84.0 | 343.1[d] |
| Age group | | | | | | | | | | | | | |
| Birth to <1 month | 68 | 141.3 | 12.6 | 5.6[d] | 11.2[d] | 20.8[d] | 95.0[d] | 149.0 | 190.5[d] | 224.0[d] | 262.6[d] | 302.0[d] | 302.0[d] |
| 1 to <3 months | 182 | 128.3 | 5.0 | 2.4[d] | 23.8[d] | 50.1[d] | 103.9 | 124.7 | 163.7 | 198.6[d] | 218.4[d] | 267.5[d] | 343.1[d] |
| 3 to <6 months | 243 | 93.1 | 4.1 | 0.6[d] | 1.9[d] | 15.6 | 60.9 | 96.6 | 121.3 | 157.3 | 173.6[d] | 225.8[d] | 252.6[d] |
| 6 to <12 months | 577 | 66.5 | 2.3 | 0.8[d] | 5.7 | 10.9 | 29.1 | 67.2 | 96.5 | 123.8 | 139.1 | 167.6[d] | 239.7[d] |
| Birth to <1 year | 1,070 | 86.4 | 2.7 | 0.8[d] | 5.7 | 14.4 | 43.7 | 85.0 | 118.4 | 156.8 | 188.9 | 239.7[d] | 343.1[d] |
| 1 to <2 years | 714 | 27.0 | 1.1 | 0.7[d] | 3.4 | 5.4 | 14.2 | 22.4 | 34.4 | 54.1 | 69.4 | 90.1[d] | 216.4[d] |
| 2 to <3 years | 741 | 29.4 | 1.2 | 0.9[d] | 3.8 | 6.0 | 12.0 | 23.6 | 41.7 | 60.2 | 71.6 | 95.3[d] | 316.2[d] |
| 3 to <6 years | 1,405 | 22.8 | 0.7 | 0.7[d] | 3.0 | 5.1 | 10.1 | 18.8 | 31.1 | 44.2 | 53.8 | 85.9[d] | 164.9[d] |
| 6 to <11 years | 2,263 | 18.7 | 0.6 | 0.4 | 2.3 | 4.0 | 8.4 | 15.2 | 25.2 | 36.2 | 47.6 | 70.9 | 157.7[d] |
| 11 to <16 years | 2,504 | 13.8 | 0.6 | 0.2 | 1.0 | 2.1 | 5.6 | 10.8 | 17.9 | 28.7 | 38.4 | 61.9 | 81.9[d] |
| 16 to <21 years | 2,129 | 15.4 | 0.5 | 0.2 | 1.3 | 2.7 | 5.9 | 12.6 | 20.9 | 32.7 | 41.0 | 53.3 | 120.6[d] |
| 21 to <30 years | 2,052 | 19.4 | 0.7 | 0.4 | 2.1 | 4.0 | 8.3 | 16.3 | 25.4 | 39.7 | 49.0 | 67.3 | 112.0[d] |
| 30 to <40 years | 2,262 | 20.5 | 0.5 | 0.6 | 3.0 | 5.0 | 10.0 | 16.9 | 28.5 | 40.9 | 47.9 | 65.0 | 95.0[d] |
| 40 to <50 years | 2,369 | 21.2 | 0.6 | 0.6 | 2.9 | 5.5 | 10.5 | 18.5 | 28.1 | 39.9 | 48.1 | 72.3 | 178.8[d] |
| 50 to <60 years | 2,095 | 21.1 | 0.5 | 0.8 | 3.0 | 5.6 | 11.1 | 18.4 | 28.4 | 38.8 | 46.6 | 72.7 | 122.9[d] |
| 60 to <70 years | 2,211 | 19.3 | 0.5 | 1.3 | 4.4 | 6.2 | 10.6 | 17.0 | 25.4 | 35.3 | 41.8 | 56.5 | 120.7[d] |
| 70 to <80 years | 1,570 | 18.2 | 0.5 | 2.0[d] | 4.3 | 6.5 | 10.1 | 16.5 | 23.2 | 32.1 | 40.2 | 56.9[d] | 80.8[d] |
| 80+ years | 914 | 16.5 | 0.4 | 2.3[d] | 4.5 | 6.2 | 9.7 | 14.8 | 22.0 | 28.1 | 32.5 | 47.6[d] | 91.8[d] |
| Birth to <2 years | 1,784 | 56.6 | 1.8 | 0.7[d] | 4.0 | 7.0 | 18.0 | 36.4 | 86.3 | 131.2 | 157.3 | 215.8[d] | 343.1[d] |
| 2 to <16 years | 6,913 | 18.6 | 0.4 | 0.3 | 1.7 | 3.5 | 7.7 | 14.2 | 24.9 | 38.7 | 49.3 | 74.6 | 316.2[d] |
| 16 to <70 years | 13,118 | 19.9 | 0.3 | 0.6 | 2.7 | 4.8 | 9.7 | 17.0 | 26.9 | 38.8 | 46.6 | 67.9 | 178.8[d] |
| 21 to <50 years | 6,683 | 20.4 | 0.4 | 0.6 | 2.7 | 4.9 | 9.7 | 17.3 | 27.7 | 40.0 | 48.4 | 68.4 | 178.8[d] |
| 50+ years | 6,790 | 19.6 | 0.3 | 1.2 | 3.8 | 6.0 | 10.6 | 17.2 | 25.6 | 35.7 | 43.4 | 65.3 | 122.9[d] |
| Race | | | | | | | | | | | | | |
| Mexican American | 5,725 | 19.7 | 0.3 | 0.4 | 2.3 | 4.0 | 8.2 | 14.7 | 24.3 | 38.2 | 50.6 | 108.4 | 296.5[d] |
| Non-Hispanic black | 5,246 | 16.5 | 0.3 | 0.3 | 1.9 | 3.2 | 6.7 | 12.5 | 20.8 | 31.7 | 40.2 | 88.4 | 343.1[d] |
| Non-Hispanic white | 10,116 | 21.0 | 0.4 | 0.6 | 2.8 | 5.0 | 10.0 | 17.6 | 27.5 | 40.2 | 49.6 | 80.3 | 284.4[d] |
| Other Hispanic | 2,058 | 20.3 | 0.7 | 0.6 | 3.0 | 4.3 | 8.7 | 14.7 | 25.6 | 39.3 | 51.5 | 112.0 | 316.2[d] |
| Other race—including multiple | 1,154 | 23.9 | 0.7 | 1.0[d] | 3.8 | 5.9 | 11.7 | 19.2 | 30.2 | 45.9 | 56.2 | 96.5[d] | 237.8[d] |

**Table 3-24. Two-Day Average[a] Consumer-Only[b] Estimates of Combined Direct and Indirect[c] Water Ingestion Based on National Health and Nutrition Examination Survey (NHANES) 2005−2010: All Sources (mL/kg-day) (Continued)**

[a] Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/.

[b] Excludes individuals who did not ingest water from the source during the survey period.

[c] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages. Does not include indirect consumption of bottled water.

[d] Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).

HNIS = Human Nutrition Information Service.
NCHS = National Center for Health Statistics.
SE = Standard error.

Source: U.S. EPA analysis of NHANES 2005−2010 data using http://fcid.foodrisk.org/.

**Table 3-25. Intake Rates of Total Fluids and Total Tap Water by Age Group**

| Age Group | Average Daily Consumption Rate (L/day) Total Fluids[a] | Total Tap Water[b] |
|---|---|---|
| 6 to 11 months | 0.80 | 0.20 |
| 2 years | 0.99 | 0.50 |
| 14 to 16 years | 1.47 | 0.72 |
| 25 to 30 years | 1.76 | 1.04 |
| 60 to 65 years | 1.63 | 1.26 |

[a] Includes milk, "ready-to-use" formula, milk-based soup, carbonated soda, alcoholic beverages, canned juices, water, coffee, tea, reconstituted juices, and reconstituted soups. Does not include reconstituted infant formula.

[b] Includes water, coffee, tea, reconstituted juices, and reconstituted soups.

Source: Derived from Pennington (1983).

**Table 3-26. Mean and Standard Error (SE) for the Daily Intake of Beverages and Tap Water by Age**

| Age years | Tap Water Intake mL | Water-Based Drinks mL[a] | Soups mL | Total Beverage Intake[b] mL |
|---|---|---|---|---|
| All ages | 662.5 ± 9.9 | 457.1 ± 6.7 | 45.9 ± 1.2 | 1,434.0 ± 13.7 |
| <1 | 170.7 ± 64.5 | 8.3 ± 43.7 | 10.1 ± 7.9 | 307.0 ± 89.2 |
| 1 to 4 | 434.6 ± 31.4 | 97.9 ± 21.5 | 43.8 ± 3.9 | 743.0 ± 43.5 |
| 5 to 9 | 521.0 ± 26.4 | 116.5 ± 18.0 | 36.6 ± 3.2 | 861.0 ± 36.5 |
| 10 to 14 | 620.2 ± 24.7 | 140.0 ± 16.9 | 35.4 ± 3.0 | 1,025.0 ± 34.2 |
| 15 to 19 | 664.7 ± 26.0 | 201.5 ± 17.7 | 34.8 ± 3.2 | 1,241.0 ± 35.9 |
| 20 to 24 | 656.4 ± 33.9 | 343.1 ± 23.1 | 38.9 ± 4.2 | 1,484.0 ± 46.9 |
| 25 to 29 | 619.8 ± 34.6 | 441.6 ± 23.6 | 41.3 ± 4.2 | 1,531.0 ± 48.0 |
| 30 to 39 | 636.5 ± 27.2 | 601.0 ± 18.6 | 40.6 ± 3.3 | 1,642.0 ± 37.7 |
| 40 to 59 | 735.3 ± 21.1 | 686.5 ± 14.4 | 51.6 ± 2.6 | 1,732.0 ± 29.3 |
| >60 | 762.5 ± 23.7 | 561.1 ± 16.2 | 59.4 ± 2.9 | 1,547.0 ± 32.8 |

[a] Includes water-based drinks such as coffee, etc. Reconstituted infant formula does not appear to be included in this group.

[b] Includes tap water and water-based drinks such as coffee, tea, soups, and other drinks such as soft drinks, fruitades, and alcoholic drinks.

Source: U.S. EPA (1984).

**Table 3-27. Average Total Tap Water Intake Rate by Sex, Age, and Geographic Area**

| Group/Subgroup | Number of Respondents | Average Total Tap Water Intake[a,b] L/day |
|---|---|---|
| Total group | 5,258 | 1.39 |
| Sex | | |
| Males | 3,892 | 1.40 |
| Females | 1,366 | 1.35 |
| Age, years | | |
| 21 to 44 | 291 | 1.30 |
| 45 to 64 | 1,991 | 1.48 |
| 65 to 84 | 2,976 | 1.33 |
| Geographic area | | |
| Atlanta | 207 | 1.39 |
| Connecticut | 844 | 1.37 |
| Detroit | 429 | 1.33 |
| Iowa | 743 | 1.61 |
| New Jersey | 1,542 | 1.27 |
| New Mexico | 165 | 1.49 |
| New Orleans | 112 | 1.61 |
| San Francisco | 621 | 1.36 |
| Seattle | 316 | 1.44 |
| Utah | 279 | 1.35 |

[a] Standard deviations not reported in Cantor et al. (1987).
[b] Total tap water defined as all water and beverages derived from tap water.

Source: Cantor et al. (1987).

**Table 3-28. Frequency Distribution of Total Tap Water Intake Rates[a]**

| Consumption Rate L/day | Frequency[b] % | Cumulative Frequency[b] % |
|---|---|---|
| ≤0.80 | 20.6 | 20.6 |
| 0.81−1.12 | 21.3 | 41.9 |
| 1.13−1.44 | 20.5 | 62.4 |
| 1.45−1.95 | 19.5 | 81.9 |
| ≥1.96 | 18.1 | 100.0 |

[a] Represents consumption of tap water and beverages derived from tap water in a "typical" winter week.
[b] Extracted from Table 3 in the article by Cantor et al. (1987).

Source: Cantor et al. (1987).

**Table 3-29. Total Tap Water Intake (mL/day) for Both Sexes Combined[a]**

| Age (years) | Number of Observations | Mean | SD | SE of Mean | Percentile Distribution | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 5 | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| <0.5 | 182 | 272 | 247 | 18 | * | 0 | 0 | 80 | 240 | 332 | 640 | 800 | * |
| 0.5 to 0.9 | 221 | 328 | 265 | 18 | * | 0 | 0 | 117 | 268 | 480 | 688 | 764 | * |
| 1 to 3 | 1,498 | 646 | 390 | 10 | 33 | 169 | 240 | 374 | 567 | 820 | 1,162 | 1,419 | 1,899 |
| 4 to 6 | 1,702 | 742 | 406 | 10 | 68 | 204 | 303 | 459 | 660 | 972 | 1,302 | 1,520 | 1,932 |
| 7 to 10 | 2,405 | 787 | 417 | 9 | 68 | 241 | 318 | 484 | 731 | 1,016 | 1,338 | 1,556 | 1,998 |
| 11 to 14 | 2,803 | 925 | 521 | 10 | 76 | 244 | 360 | 561 | 838 | 1,196 | 1,621 | 1,924 | 2,503 |
| 15 to 19 | 2,998 | 999 | 593 | 11 | 55 | 239 | 348 | 587 | 897 | 1,294 | 1,763 | 2,134 | 2,871 |
| 20 to 44 | 7,171 | 1,255 | 709 | 8 | 105 | 337 | 483 | 766 | 1,144 | 1,610 | 2,121 | 2,559 | 3,634 |
| 45 to 64 | 4,560 | 1,546 | 723 | 11 | 335 | 591 | 745 | 1,057 | 1,439 | 1,898 | 2,451 | 2,870 | 3,994 |
| 65 to 74 | 1,663 | 1,500 | 660 | 16 | 301 | 611 | 766 | 1,044 | 1,394 | 1,873 | 2,333 | 2,693 | 3,479 |
| >75 | 878 | 1,381 | 600 | 20 | 279 | 568 | 728 | 961 | 1,302 | 1,706 | 2,170 | 2,476 | 3,087 |
| Infants (ages <1) | 403 | 302 | 258 | 13 | 0 | 0 | 0 | 113 | 240 | 424 | 649 | 775 | 1,102 |
| Children (ages 1 to 10) | 5,605 | 736 | 410 | 5 | 56 | 192 | 286 | 442 | 665 | 960 | 1,294 | 1,516 | 1,954 |
| Teens (ages 11 to 19) | 5,801 | 965 | 562 | 7 | 67 | 240 | 353 | 574 | 867 | 1,246 | 1,701 | 2,026 | 2,748 |
| Adults (ages 20 to 64) | 11,731 | 1,366 | 728 | 7 | 148 | 416 | 559 | 870 | 1,252 | 1,737 | 2,268 | 2,707 | 3,780 |
| Adults (ages >65) | 2,541 | 1,459 | 643 | 13 | 299 | 598 | 751 | 1,019 | 1,367 | 1,806 | 2,287 | 2,636 | 3,338 |
| All | 26,081 | 1,193 | 702 | 4 | 80 | 286 | 423 | 690 | 1,081 | 1,561 | 2,092 | 2,477 | 3,415 |

[a] Total tap water is defined as "all water from the household tap consumed directly as a beverage or used to prepare foods and beverages."
* Value not reported due to insufficient number of observations.
SE = Standard error.

Source: Ershow and Cantor (1989).

**Table 3-30. Total Tap Water Intake (mL/kg-day) for Both Sexes Combined[a]**

| Age (years) | Number of Observations | | Mean | SD | SE of Mean | Percentile Distribution | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Actual Count | Weighted Count | | | | 1 | 5 | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| <0.5 | 182 | 201.2 | 52.4 | 53.2 | 3.9 | * | 0 | 0 | 14.8 | 37.8 | 66.1 | 128.3 | 155.6 | * |
| 0.5 to 0.9 | 221 | 243.2 | 36.2 | 29.2 | 2 | * | 0 | 0 | 15.3 | 32.2 | 48.1 | 69.4 | 102.9 | * |
| 1 to 3 | 1,498 | 1,687.7 | 46.8 | 28.1 | 0.7 | 2.7 | 11.8 | 17.8 | 27.2 | 41.4 | 60.4 | 82.1 | 101.6 | 140.6 |
| 4 to 6 | 1,702 | 1,923.9 | 37.9 | 21.8 | 0.5 | 3.4 | 10.3 | 14.9 | 21.9 | 33.3 | 48.7 | 69.3 | 81.1 | 103.4 |
| 7 to 10 | 2,405 | 2,742.4 | 26.9 | 15.3 | 0.3 | 2.2 | 7.4 | 10.3 | 16 | 24 | 35.5 | 47.3 | 55.2 | 70.5 |
| 11 to 14 | 2,803 | 3,146.9 | 20.2 | 11.6 | 0.2 | 1.5 | 4.9 | 7.5 | 11.9 | 18.1 | 26.2 | 35.7 | 41.9 | 55 |
| 15 to 19 | 2,998 | 3,677.9 | 16.4 | 9.6 | 0.2 | 1 | 3.9 | 5.7 | 9.6 | 14.8 | 21.5 | 29 | 35 | 46.3 |
| 20 to 44 | 7,171 | 13,444.5 | 18.6 | 10.7 | 0.1 | 1.6 | 4.9 | 7.1 | 11.2 | 16.8 | 23.7 | 32.2 | 38.4 | 53.4 |
| 45 to 64 | 4,560 | 8,300.4 | 22 | 10.8 | 0.2 | 4.4 | 8 | 10.3 | 14.7 | 20.2 | 27.2 | 35.5 | 42.1 | 57.8 |
| 65 to 74 | 1,663 | 2,740.2 | 21.9 | 9.9 | 0.2 | 4.6 | 8.7 | 10.9 | 15.1 | 20.2 | 27.2 | 35.2 | 40.6 | 51.6 |
| >75 | 878 | 1,401.8 | 21.6 | 9.5 | 0.3 | 3.8 | 8.8 | 10.7 | 15 | 20.5 | 27.1 | 33.9 | 38.6 | 47.2 |
| Infants (ages <1) | 403 | 444.3 | 43.5 | 42.5 | 2.1 | 0 | 0 | 0 | 15.3 | 35.3 | 54.7 | 101.8 | 126.5 | 220.5 |
| Children (ages 1 to 10) | 5,605 | 6,354.1 | 35.5 | 22.9 | 0.3 | 2.7 | 8.3 | 12.5 | 19.6 | 30.5 | 46.0 | 64.4 | 79.4 | 113.9 |
| Teens (ages 11 to 19) | 5,801 | 6,824.9 | 18.2 | 10.8 | 0.1 | 1.2 | 4.3 | 6.5 | 10.6 | 16.3 | 23.6 | 32.3 | 38.9 | 52.6 |
| Adults (ages 20 to 64) | 11,731 | 21,744.9 | 19.9 | 10.8 | 0.1 | 2.2 | 5.9 | 8.0 | 12.4 | 18.2 | 25.3 | 33.7 | 40.0 | 54.8 |
| Adults (ages >65) | 2,541 | 4,142.0 | 21.8 | 9.8 | 0.2 | 4.5 | 8.7 | 10.9 | 15.0 | 20.3 | 27.1 | 34.7 | 40.0 | 51.3 |
| All | 26,081 | 39,510.2 | 22.6 | 15.4 | 0.1 | 1.7 | 5.8 | 8.2 | 13.0 | 19.4 | 28.0 | 39.8 | 50.0 | 79.8 |

[a] Total tap water is defined as "all water from the household tap consumed directly as a beverage or used to prepare foods and beverages."

* Value not reported due to insufficient number of observations.

SE = Standard error.

Source: Ershow and Cantor (1989).

**Table 3-31. Total Tap Water Intake (as % of total water intake) by Broad Age Category[a,b]**

| Age (years) | Mean | Percentile Distribution | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 5 | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| <1 | 26 | -[c] | -[c] | -[c] | 12 | 22 | 37 | 55 | 62 | 82 |
| 1 to 10 | 45 | 6 | 19 | 24 | 34 | 45 | 57 | 67 | 72 | 81 |
| 11 to 19 | 47 | 6 | 18 | 24 | 35 | 47 | 59 | 69 | 74 | 83 |
| 20 to 64 | 59 | 12 | 27 | 35 | 49 | 61 | 72 | 79 | 83 | 90 |
| >65 | 65 | 25 | 41 | 47 | 58 | 67 | 74 | 81 | 84 | 90 |

[a] Does not include pregnant women, lactating women, or breast-fed children.
[b] Total tap water is defined as "all water from the household tap consumed directly as a beverage or used to prepare foods and beverages."
[c] Value is less than 0.5%.

Source: Ershow and Cantor (1989).

**Table 3-32. General Dietary Sources of Tap Water for Both Sexes[a,b]**

| Age years | Source | % of Tap Water | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | SD | 5 | 25 | 50 | 75 | 95 | 99 |
| <1 | Food[c] | 11 | 24 | -[d] | -[d] | -[d] | 10 | 70 | 100 |
| | Drinking water | 69 | 37 | -[d] | 39 | 87 | 100 | 100 | 100 |
| | Other beverages | 20 | 33 | -[d] | -[d] | -[d] | 22 | 100 | 100 |
| | All sources | 100 | | | | | | | |
| 1 to 10 | Food[c] | 15 | 16 | -[d] | 5 | 10 | 19 | 44 | 100 |
| | Drinking water | 65 | 25 | -[d] | 52 | 70 | 84 | 96 | 100 |
| | Other beverages | 20 | 21 | -[d] | -[d] | 15 | 32 | 63 | 93 |
| | All sources | 100 | | | | | | | |
| 11 to 19 | Food[c] | 13 | 15 | -[d] | 3 | 8 | 17 | 38 | 100 |
| | Drinking water | 65 | 25 | -[d] | 52 | 70 | 85 | 98 | 100 |
| | Other beverages | 22 | 23 | -[d] | -[d] | 16 | 34 | 68 | 96 |
| | All sources | 100 | | | | | | | |
| 20 to 64 | Food[c] | 8 | 10 | -[d] | 2 | 5 | 11 | 25 | 49 |
| | Drinking water | 47 | 26 | -[d] | 29 | 48 | 67 | 91 | 100 |
| | Other beverages | 45 | 26 | -[d] | 25 | 44 | 63 | 91 | 100 |
| | All sources | 100 | | | | | | | |
| >65 | Food[c] | 8 | 9 | -[d] | 2 | 5 | 11 | 23 | 38 |
| | Drinking water | 50 | 23 | -[d] | 36 | 52 | 66 | 87 | 99 |
| | Other beverages | 42 | 23 | 3 | 27 | 40 | 57 | 85 | 100 |
| | All sources | 100 | | | | | | | |
| All | Food[c] | 10 | 13 | -[d] | 2 | 6 | 13 | 31 | 64 |
| | Drinking water | 54 | 27 | -[d] | 36 | 56 | 75 | 95 | 100 |
| | Other beverages | 36 | 27 | -[d] | 14 | 34 | 55 | 87 | 100 |
| | All sources | 100 | | | | | | | |

[a] Does not include pregnant women, lactating women, or breast-fed children.
[b] Individual values may not add to totals due to rounding.
[c] Food category includes soups.
[d] Value is less than 0.5%.

Source: Ershow and Cantor (1989).

**Table 3-33. Summary Statistics for Best-Fit Lognormal Distributions for Water Intake Rates[a]**

| Group years | In Total Fluid Intake Rate | | |
|---|---|---|---|
| | μ | σ | $R^2$ |
| <1 | 6.979 | 0.291 | 0.996 |
| 1 to <11 | 7.182 | 0.340 | 0.953 |
| 11 to <20 | 7.490 | 0.347 | 0.966 |
| 20 to <65 | 7.563 | 0.400 | 0.977 |
| >65 | 7.583 | 0.360 | 0.988 |
| All ages | 7.487 | 0.405 | 0.984 |
| Simulated balanced population | 7.492 | 0.407 | 1.000 |
| Group years | In Total Fluid Intake Rate | | |
| | μ | σ | $R^2$ |
| <1 | 5.587 | 0.615 | 0.970 |
| 1 to <11 | 6.429 | 0.498 | 0.984 |
| 11 to <20 | 6.667 | 0.535 | 0.986 |
| 20 to <65 | 7.023 | 0.489 | 0.956 |
| >65 | 7.088 | 0.476 | 0.978 |
| All ages | 6.870 | 0.530 | 0.978 |
| Simulated balanced population | 6.864 | 0.575 | 0.995 |

[a] These values (mL/day) were used in the following equations to estimate the quantiles and averages for total tap water intake shown in Table 3-61.
97.5 percentile intake rate = exp (μ + [1.96 × σ])
75 percentile intake rate = exp (μ + [0.6745 × σ])
50 percentile intake rate = exp (μ)
25 percentile intake rate = exp (μ − [0.6745 × σ])
2.5 percentile intake rate = exp (μ − [1.96 × σ])
Mean intake rate = exp (μ + [0.5 × $\sigma^2$])
μ = Mean.
σ = Standard deviation.

Source: Roseberry and Burmaster (1992).

**Table 3-34. Estimated Quantiles and Means for Total Tap Water Intake Rates (mL/day)[a]**

| Age Group years | Percentile | | | | | Arithmetic Average |
|---|---|---|---|---|---|---|
| | 2.5 | 25 | 50 | 75 | 97.5 | |
| <1 | 80 | 176 | 267 | 404 | 891 | 323 |
| 1 to <11 | 233 | 443 | 620 | 867 | 1,644 | 701 |
| 11 to <20 | 275 | 548 | 786 | 1,128 | 2,243 | 907 |
| 20 to <65 | 430 | 807 | 1,122 | 1,561 | 2,926 | 1,265 |
| >65 | 471 | 869 | 1,198 | 1,651 | 3,044 | 1,341 |
| All ages | 341 | 674 | 963 | 1,377 | 2,721 | 1,108 |
| Simulated balanced population | 310 | 649 | 957 | 1,411 | 2,954 | 1,129 |

[a] Total tap water is defined as "all water from the household tap consumed directly as a beverage or used to prepare foods and beverages."

Source: Roseberry and Burmaster (1992).

**Table 3-35. Water Ingested (mL/day)[a] from Water by Itself and Water Added to Other Beverages and Foods**

| Category | | 6 Weeks *N* = 124 | 3 Months *N* = 120 | 6 Months *N* = 99 | 9 Months *N* = 77 |
|---|---|---|---|---|---|
| Water by itself | Range | 0−355 | 0−355 | 0−266 | 0−473 |
| | Per capita mean[b] ± SD | 30 ± 89 | 30 ± 59 | 30 ± 59 | 89 ± 89 |
| | Consumer-only mean[c] | 89 | 89 | 118 | 118 |
| | Percent consuming[d] | 28 | 24 | 42 | 66 |
| Water added to formula-powdered concentrate | Range | 0−1,242 | 0−1,242 | 0−1,124 | 0−1,064 |
| | Per capita mean ± SD | 177 ± 296 | 266 ± 384 | 266 ± 355 | 207 ± 325 |
| | Consumer-only mean | 473 | 621 | 562 | 562 |
| | Percent consuming | 39 | 42 | 48 | 36 |
| Liquid concentrate | Range | 0−621 | 0−680 | 0−710 | 0−532 |
| | Per capita mean ± SD | 89 ± 148 | 237 ± 207 | 148 ± 207 | 59 ± 148 |
| | Consumer-only mean | 355 | 384 | 414 | 325 |
| | Percent consuming | 23 | 30 | 35 | 21 |
| All concentrated formula | Range | 0−1,242 | 0−1,242 | 0−1,123 | 0−1,064 |
| | Per capita mean ± SD | 266 ± 296 | 384 ± 355 | 414 ± 325 | 266 ± 296 |
| | Consumer-only mean | 444 | 562 | 532 | 503 |
| | Percent consuming | 60 | 68 | 81 | 56 |
| Water added to juices and other beverages | Range | 0−118 | 0−710 | 0−473 | 0−887 |
| | Per capita mean ± SD | <30 ± 30 | 30 ± 89 | 30 ± 89 | 59 ± 148 |
| | Consumer-only mean | 89 | 207 | 148 | 207 |
| | Percent consuming | 3 | 9 | 18 | 32 |
| Water added to powdered baby foods and cereals | Range | 0−30 | 0−177 | 0−266 | 0−177 |
| | Per capita mean ± SD | <30 ± 30 | <30 ± 30 | 59 ± 59 | 30 ± 59 |
| | Consumer-only mean | 30 | 59 | 89 | 89 |
| | Percent consuming | 2 | 17 | 64 | 43 |
| Water added to other foods (soups, Jell-o, puddings) | Range | - | 0−118 | 0−118 | 0−355 |
| | Per capita mean ± SD | - | 30 ± 30 | <30 ± 30 | 30 ± 59 |
| | Consumer-only mean | - | 89 | 59 | 118 |
| | Percent consuming | 0 | 2 | 8 | 29 |

**Table 3-35. Water Ingested (mL/day)[a] from Water by Itself and Water Added to Other Beverages and Foods (Continued)**

| Category | | 6 Weeks *N* = 124 | 3 Months *N* = 120 | 6 Months *N* = 99 | 9 Months *N* = 77 |
|---|---|---|---|---|---|
| All sources of water | Range | 0−1,242 | 0−1,419 | 0−1,123 | 0−1,745 |
| | Per capita mean ± SD | 296 ± 325 | 414 ± 414 | 473 ± 325 | 444 ± 355 |
| | Consumer-only mean | 414 | 562 | 503 | 473 |
| | Percent consuming | 68 | 77 | 94 | 97 |

[a] Converted from ounces/day; 1 fluid ounce = 29.57 mL.
[b] Mean intake among entire sample.
[c] Mean intake for only those ingesting water from the particular category.
[d] Percentage of infants receiving water from that individual source.
*N* = Number of observations.
- Indicates there is insufficient sample size to estimate means.

Source: Levy et al. (1995).

**Table 3-36. Mean per Capita Drinking Water Intake Based on U.S. Department of Agriculture (USDA), Continuing Survey of Food Intake by Individuals (CSFII) Data from 1989−1991 (mL/day)**

| Sex and Age years | Plain Drinking Water | Coffee | Tea | Fruit Drinks and Ades[a] | Total |
|---|---|---|---|---|---|
| Males and females: | | | | | |
| <1 | 194 | 0 | <0.5 | 17 | 211.5 |
| 1 to 2 | 333 | <0.5 | 9 | 85 | 427.5 |
| 3 to 5 | 409 | 2 | 26 | 100 | 537 |
| ≤5 | 359 | 1 | 17 | 86 | 463 |
| Males: | | | | | |
| 6 to 11 | 537 | 2 | 44 | 114 | 697 |
| 12 to 19 | 725 | 12 | 95 | 104 | 936 |
| 20 to 29 | 842 | 168 | 136 | 101 | 1,247 |
| 30 to 39 | 793 | 407 | 136 | 50 | 1,386 |
| 40 to 49 | 745 | 534 | 149 | 53 | 1,481 |
| 50 to 59 | 755 | 551 | 168 | 51 | 1,525 |
| 60 to 69 | 946 | 506 | 115 | 34 | 1,601 |
| 70 to 79 | 824 | 430 | 115 | 45 | 1,414 |
| ≥80 | 747 | 326 | 165 | 57 | 1,295 |
| ≥20 | 809 | 408 | 139 | 60 | 1,416 |
| Females: | | | | | |
| 6 to 11 | 476 | 1 | 40 | 86 | 603 |
| 12 to 19 | 604 | 21 | 87 | 87 | 799 |
| 20 to 29 | 739 | 154 | 120 | 61 | 1,074 |
| 30 to 39 | 732 | 317 | 136 | 59 | 1,244 |
| 40 to 49 | 781 | 412 | 174 | 36 | 1,403 |
| 50 to 59 | 819 | 438 | 137 | 37 | 1,431 |
| 60 to 69 | 829 | 429 | 124 | 36 | 1,418 |
| 70 to 79 | 772 | 324 | 161 | 34 | 1,291 |
| >80 | 856 | 275 | 149 | 28 | 1,308 |
| >20 | 774 | 327 | 141 | 46 | 1,288 |
| All individuals | 711 | 260 | 114 | 65 | 1,150 |

[a] Includes regular and low-calorie fruit drinks, punches, and ades, including those made from powdered mix and frozen concentrate. Excludes fruit juices and carbonated drinks.

Source: USDA (1995).

**Table 3-37. Number of Respondents Who Consumed Tap Water at a Specified Daily Frequency**

| Population Group | Total *N* | None | Number of Glasses in a Day | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1−2 | 3−5 | 6−9 | 10−19 | 20+ | DK |
| Overall | 4,663 | 1,334 | 1,225 | 1,253 | 500 | 151 | 31 | 138 |
| Sex | | | | | | | | |
| Male | 2,163 | 604 | 582 | 569 | 216 | 87 | 25 | 65 |
| Female | 2,498 | 728 | 643 | 684 | 284 | 64 | 6 | 73 |
| Refused | 2 | 2 | - | - | - | - | - | - |
| Age (years) | | | | | | | | |
| 1 to 4 | 263 | 114 | 96 | 40 | 7 | 1 | 0 | 5 |
| 5 to 11 | 348 | 90 | 127 | 86 | 15 | 7 | 2 | 20 |
| 12 to 17 | 326 | 86 | 109 | 88 | 22 | 7 | - | 11 |
| 18 to 64 | 2,972 | 908 | 751 | 769 | 334 | 115 | 26 | 54 |
| >64 | 670 | 117 | 127 | 243 | 112 | 20 | 2 | 42 |
| Race | | | | | | | | |
| White | 3,774 | 1,048 | 1,024 | 1,026 | 416 | 123 | 25 | 92 |
| Black | 463 | 147 | 113 | 129 | 38 | 9 | 1 | 21 |
| Asian | 77 | 25 | 18 | 23 | 6 | 1 | - | 4 |
| Some others | 96 | 36 | 18 | 22 | 6 | 7 | 2 | 5 |
| Hispanic | 193 | 63 | 42 | 40 | 28 | 10 | 2 | 7 |
| Refused | 60 | 15 | 10 | 13 | 6 | 1 | 1 | 9 |
| Hispanic | | | | | | | | |
| No | 4,244 | 1,202 | 1,134 | 1,162 | 451 | 129 | 26 | 116 |
| Yes | 347 | 116 | 80 | 73 | 41 | 18 | 4 | 13 |
| DK | 26 | 5 | 6 | 7 | 4 | 3 | - | 1 |
| Refused | 46 | 11 | 5 | 11 | 4 | 1 | 1 | 8 |
| Employment | | | | | | | | |
| Full-time | 2,017 | 637 | 525 | 497 | 218 | 72 | 18 | 40 |
| Part-time | 379 | 90 | 94 | 120 | 50 | 13 | 7 | 5 |
| Not employed | 1,309 | 313 | 275 | 413 | 188 | 49 | 3 | 54 |
| Refused | 32 | 6 | 4 | 11 | 1 | 2 | 1 | 4 |
| Education | | | | | | | | |
| <High school | 399 | 89 | 95 | 118 | 51 | 14 | 2 | 28 |
| High school graduate | 1,253 | 364 | 315 | 330 | 132 | 52 | 13 | 37 |
| <College | 895 | 258 | 197 | 275 | 118 | 31 | 5 | 9 |
| College graduate | 650 | 195 | 157 | 181 | 82 | 19 | 4 | 6 |
| Post graduate | 445 | 127 | 109 | 113 | 62 | 16 | 3 | 12 |
| Census region | | | | | | | | |
| Northeast | 1,048 | 351 | 262 | 266 | 95 | 32 | 7 | 28 |
| Midwest | 1,036 | 243 | 285 | 308 | 127 | 26 | 9 | 33 |
| South | 1,601 | 450 | 437 | 408 | 165 | 62 | 11 | 57 |
| West | 978 | 290 | 241 | 271 | 113 | 31 | 4 | 20 |
| Day of week | | | | | | | | |
| Weekday | 3,156 | 864 | 840 | 862 | 334 | 96 | 27 | 106 |
| Weekend | 1,507 | 470 | 385 | 391 | 166 | 55 | 4 | 32 |
| Season | | | | | | | | |
| Winter | 1,264 | 398 | 321 | 336 | 128 | 45 | 5 | 26 |
| Spring | 1,181 | 337 | 282 | 339 | 127 | 33 | 10 | 40 |
| Summer | 1,275 | 352 | 323 | 344 | 155 | 41 | 9 | 40 |
| Fall | 943 | 247 | 299 | 234 | 90 | 32 | 7 | 32 |

**Table 3-37. Number of Respondents Who Consumed Tap Water at a Specified Daily Frequency (Continued)**

| Population Group | Total *N* | None | Number of Glasses in a Day 1−2 | 3−5 | 6−9 | 10−19 | 20+ | DK |
|---|---|---|---|---|---|---|---|---|
| Asthma | | | | | | | | |
| No | 4,287 | 1,232 | 1,137 | 1,155 | 459 | 134 | 29 | 115 |
| Yes | 341 | 96 | 83 | 91 | 40 | 16 | 1 | 13 |
| DK | 35 | 6 | 5 | 7 | 1 | 1 | 1 | 10 |
| Angina | | | | | | | | |
| No | 4,500 | 1,308 | 1,195 | 1,206 | 470 | 143 | 29 | 123 |
| Yes | 125 | 18 | 25 | 40 | 27 | 6 | 1 | 6 |
| DK | 38 | 8 | 5 | 7 | 3 | 2 | 1 | 9 |
| Bronchitis/emphysema | | | | | | | | |
| No | 4,424 | 1,280 | 1,161 | 1,189 | 474 | 142 | 29 | 124 |
| Yes | 203 | 48 | 55 | 58 | 24 | 9 | 1 | 5 |
| DK | 36 | 6 | 9 | 6 | 2 | - | 1 | 9 |

\- = Missing data.
DK = Don't know.
*N* = Sample size.
Refused = Respondent refused to answer.

Source: U.S. EPA (1996).

**Table 3-38. Number of Respondents Who Consumed Juice Reconstituted with Tap Water at a Specified Daily Frequency**

| Population Group | Total *N* | Number of Glasses in a Day None | 1−2 | 3−5 | 6−9 | 10−19 | 20+ | DK |
|---|---|---|---|---|---|---|---|---|
| Overall | 4,663 | 1,877 | 1,418 | 933 | 241 | 73 | 21 | 66 |
| Sex | | | | | | | | |
| Male | 2,163 | 897 | 590 | 451 | 124 | 35 | 17 | 33 |
| Female | 2,498 | 980 | 826 | 482 | 117 | 38 | 4 | 33 |
| Refused | 2 | - | 2 | - | - | - | - | - |
| Age (years) | | | | | | | | |
| 1 to 4 | 263 | 126 | 71 | 48 | 11 | 4 | 1 | 2 |
| 5 to 11 | 348 | 123 | 140 | 58 | 12 | 2 | 1 | 11 |
| 12 to 17 | 326 | 112 | 118 | 63 | 18 | 7 | 1 | 4 |
| 18 to 64 | 2,972 | 1,277 | 817 | 614 | 155 | 46 | 16 | 30 |
| >64 | 670 | 206 | 252 | 133 | 43 | 12 | 2 | 14 |
| Race | | | | | | | | |
| White | 3,774 | 1,479 | 1,168 | 774 | 216 | 57 | 16 | 44 |
| Black | 463 | 200 | 142 | 83 | 15 | 9 | 1 | 7 |
| Asian | 77 | 33 | 27 | 15 | 1 | - | - | 0 |
| Some others | 96 | 46 | 19 | 24 | 2 | 1 | 3 | 1 |
| Hispanic | 193 | 95 | 51 | 30 | 5 | 5 | 1 | 5 |
| Refused | 60 | 24 | 11 | 7 | 2 | 1 | - | 9 |

**Table 3-38. Number of Respondents Who Consumed Juice Reconstituted with Tap Water at a Specified Daily Frequency (Continued)**

| Population Group | Total *N* | Number of Glasses in a Day | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | None | 1−2 | 3−5 | 6−9 | 10−19 | 20+ | DK |
| Hispanic | | | | | | | | |
| No | 4,244 | 1,681 | 1,318 | 863 | 226 | 64 | 17 | 49 |
| Yes | 347 | 165 | 87 | 61 | 14 | 7 | 4 | 7 |
| DK | 26 | 11 | 6 | 5 | - | 1 | - | 3 |
| Refused | 46 | 20 | 7 | 4 | 1 | 1 | - | 7 |
| Employment | | | | | | | | |
| Full-time | 2,017 | 871 | 559 | 412 | 103 | 32 | 9 | 20 |
| Part-time | 379 | 156 | 102 | 88 | 19 | 7 | 2 | 5 |
| Not employed | 1,309 | 479 | 426 | 265 | 75 | 20 | 7 | 21 |
| Refused | 32 | 15 | 4 | 4 | 2 | 1 | - | 3 |
| Education | | | | | | | | |
| <High school | 399 | 146 | 131 | 82 | 25 | 7 | 2 | 4 |
| High school graduate | 1,253 | 520 | 355 | 254 | 68 | 21 | 7 | 17 |
| <College | 895 | 367 | 253 | 192 | 47 | 18 | 5 | 11 |
| College graduate | 650 | 274 | 201 | 125 | 31 | 7 | 1 | 5 |
| Post graduate | 445 | 182 | 130 | 92 | 26 | 5 | 3 | 4 |
| Census region | | | | | | | | |
| Northeast | 1,048 | 440 | 297 | 220 | 51 | 13 | 4 | 15 |
| Midwest | 1,036 | 396 | 337 | 200 | 63 | 17 | 4 | 14 |
| South | 1,601 | 593 | 516 | 332 | 84 | 26 | 10 | 28 |
| West | 978 | 448 | 268 | 181 | 43 | 17 | 3 | 9 |
| Day of week | | | | | | | | |
| Weekday | 3,156 | 1,261 | 969 | 616 | 162 | 51 | 11 | 46 |
| Weekend | 1,507 | 616 | 449 | 307 | 79 | 22 | 10 | 20 |
| Season | | | | | | | | |
| Winter | 1,264 | 529 | 382 | 245 | 66 | 23 | 4 | 10 |
| Spring | 1,181 | 473 | 382 | 215 | 54 | 19 | 8 | 17 |
| Summer | 1,275 | 490 | 389 | 263 | 68 | 18 | 6 | 28 |
| Fall | 943 | 385 | 265 | 210 | 53 | 13 | 3 | 11 |
| Asthma | | | | | | | | |
| No | 4,287 | 1,734 | 1,313 | 853 | 216 | 69 | 20 | 55 |
| Yes | 341 | 130 | 102 | 74 | 25 | 3 | 1 | 5 |
| DK | 35 | 13 | 3 | 6 | - | 1 | - | 6 |
| Angina | | | | | | | | |
| No | 4,500 | 1,834 | 1,362 | 900 | 231 | 67 | 20 | 59 |
| Yes | 125 | 31 | 53 | 25 | 7 | 5 | 1 | 1 |
| DK | 38 | 12 | 3 | 8 | 3 | 1 | - | 6 |
| Bronchitis/emphysema | | | | | | | | |
| No | 4,424 | 1,782 | 1,361 | 882 | 230 | 65 | 21 | 57 |
| Yes | 203 | 84 | 53 | 44 | 10 | 6 | - | 3 |
| DK | 36 | 11 | 4 | 7 | 1 | 2 | - | 6 |

- = Missing data.
DK = Don't know.
*N* = Sample size.
Refused = Respondent refused to answer.

Source: U.S. EPA (1996).

**Table 3-39. Mean and (standard error [SE]) Water and Drink Consumption (mL/kg-day) by Race/Ethnicity**

| Race/Ethnic Group | *N* | Plain Tap Water | Milk and Milk Drinks | Reconstituted Formula | RTF Formula | Baby Food | Juices and Carbonated Drinks | Noncarbonated Drinks | Other | Total[a] |
|---|---|---|---|---|---|---|---|---|---|---|
| Black Non-Hispanic | 121 | 21 (1.7) | 24 (4.6) | 35 (6.0) | 4 (2.0) | 8 (1.6) | 2 (0.7) | 14 (1.3) | 21 (1.7) | 129 (5.7) |
| White Non-Hispanic | 620 | 13 (0.8) | 23 (1.2) | 29 (2.7) | 8 (1.5) | 10 (1.2) | 1 (0.2) | 11 (0.7) | 18 (0.8) | 113 (2.6) |
| Hispanic | 146 | 15 (1.2) | 23 (2.4) | 38 (7.3) | 12 (4.0) | 10 (1.4) | 1 (0.3) | 10 (1.6) | 16 (1.4) | 123 (5.2) |
| Other | 59 | 21 (2.4) | 19 (3.7) | 31 (9.1) | 19 (11.2) | 7 (4.0) | 1 (0.5) | 8 (2.0) | 19 (3.2) | 124 (10.6) |

[a] Totals may be slightly different from the sums of all categories due to rounding.
*N* = Number of observations.
RTF = Ready to feed.

Source: Heller et al. (2000).

**Table 3-40. Plain Tap Water and Total Water Consumption by Age, Sex, Region, Urbanicity, and Poverty Category**

| | | Plain Tap Water mL/kg-day | | Total Water mL/kg-day | |
|---|---|---|---|---|---|
| Variable | *N* | Mean | SE | Mean | SE |
| Age | | | | | |
| <12 months | 296 | 11 | 1.0 | 130 | 4.6 |
| 12 to 24 months | 650 | 18 | 0.8 | 108 | 1.7 |
| Sex | | | | | |
| Male | 475 | 15 | 1.0 | 116 | 4.1 |
| Female | 471 | 15 | 0.8 | 119 | 3.2 |
| Region | | | | | |
| Northeast | 175 | 13 | 1.4 | 121 | 6.3 |
| Midwest | 197 | 14 | 1.0 | 120 | 3.1 |
| South | 352 | 15 | 1.3 | 113 | 3.7 |
| West | 222 | 17 | 1.1 | 119 | 4.6 |
| Urbanicity | | | | | |
| Urban | 305 | 16 | 1.5 | 123 | 3.5 |
| Suburban | 446 | 13 | 0.9 | 117 | 3.1 |
| Rural | 195 | 15 | 1.2 | 109 | 3.9 |
| Poverty category[a] | | | | | |
| 0−1.30 | 289 | 19 | 1.5 | 128 | 2.6 |
| 1.31−3.50 | 424 | 14 | 1.0 | 117 | 4.2 |
| >3.50 | 233 | 12 | 1.3 | 109 | 3.5 |
| Total | 946 | 15 | 0.6 | 118 | 2.3 |

[a] Poverty category represents family's annual incomes of 0−1.30, 1.31−3.50, and greater than 3.50 times the federal poverty level.
*N* = Number of observations.
SE = Standard Error.

Source: Heller et al. (2000).

**Table 3-41. Percentage of Subjects Consuming Beverages and Mean Daily Beverage Intakes (mL/day) for Children with Returned Questionnaires**

| Age at Questionnaire<br>Actual Age (months)<br>*N*[b] | 6 Months<br>6.29 ± 0.35<br>677 | 9 Months<br>9.28 ± 0.35<br>681 | 12 Months<br>12.36 ± 0.46<br>659 | 16 Months<br>16.31 ± 0.49<br>641 | 20 Months<br>20.46 ± 0.57<br>632 | 24 Months<br>24.41 ± 0.53<br>605 | 6 to 24 Months[a]<br>-<br>585[c] |
|---|---|---|---|---|---|---|---|
| Human milk[d] | 30 | 19 | 11 | 5 | 3 | 0 | - |
| Infant formula[e] | | | | | | | |
| %[d] | 68 | 69 | 29 | 4 | 2 | 0 | 67[f] |
| mL/day[g] | 798 ± 234 | 615 ± 328 | 160 ± 275 | 12 ± 77 | 9 ± 83 | - | 207 ± 112 |
| Cow's milk[e] | | | | | | | |
| %[d] | 5 | 25 | 79 | 91 | 93 | 97 | 67[f] |
| mL/day[g] | 30 ± 145 | 136 ± 278 | 470 ± 310 | 467 ± 251 | 402 ± 237 | 358 ± 225 | 355 ± 163 |
| Formula and cow's milk[e] | | | | | | | |
| %[d] | 70 | 81 | 88 | 92 | 94 | 98 | 67[f] |
| mL/day[g] | 828 ± 186 | 751 ± 213 | 630 ± 245 | 479 ± 248 | 411 ± 237 | 358 ± 228 | 562 ± 154 |
| Juice and juice drinks | | | | | | | |
| %[d] | 55 | 73 | 89 | 94 | 95 | 93 | 99[h] |
| mL/day[g] | 65 ± 95 | 103 ± 112 | 169 ± 151 | 228 ± 166 | 269 ± 189 | 228 ± 172 | 183 ± 103 |
| Water | | | | | | | |
| %[d] | 36 | 59 | 75 | 87 | 90 | 94 | 99[h] |
| mL/day[g] | 27 ± 47 | 53 ± 71 | 92 ± 109 | 124 ± 118 | 142 ± 127 | 145 ± 148 | 109 ± 74 |
| Other beverages[i] | | | | | | | |
| %[d] | 1 | 9 | 23 | 42 | 62 | 86 | 80[h] |
| mL/day[g] | 3 ± 18 | 6 ± 27 | 27 ± 71 | 53 ± 109 | 83 ± 121 | 89 ± 133 | 44 ± 59 |

**Table 3-41. Percentage of Subjects Consuming Beverages and Mean Daily Beverage Intakes (mL/day) for Children with Returned Questionnaires (Continued)**

| Age at Questionnaire | 6 Months | 9 Months | 12 Months | 16 Months | 20 Months | 24 Months | 6 to 24 Months[a] |
|---|---|---|---|---|---|---|---|
| Actual Age (months) | 6.29 ± 0.35 | 9.28 ± 0.35 | 12.36 ± 0.46 | 16.31 ± 0.49 | 20.46 ± 0.57 | 24.41 ± 0.53 | - |
| *N*[b] | 677 | 681 | 659 | 641 | 632 | 605 | 585[c] |
| Total beverages (mL/day)[e,g,j] | 934 ± 219 | 917 ± 245 | 926 ± 293 | 887 ± 310 | 908 ± 310 | 819 ± 299 | 920 ± 207 |

[a] Cumulative number of children and percentage of children consuming beverage and beverage intakes for the 6- through 24-month period.
[b] Number of children with returned questionnaires at each time period.
[c] Number of children with cumulative intakes for 6- through 24-month period.
[d] Percentage of children consuming beverage.
[e] Children are not included when consuming human milk.
[f] Percentage of children consuming beverage during 6- through 24-month period. Children who consumed human milk are not included.
[g] Mean standard deviation of beverage intake. Converted from ounces/day; 1 fluid ounce = 29.57 mL.
[h] Percentage of children consuming beverage during 6- through 24-month period.
[i] Other beverages include nonjuice beverages (e.g., carbonated beverages, Kool-Aid).
[j] Total beverages includes all beverages except human milk.
- Indicates insufficient data.

Source: Marshall et al. (2003a).

**Table 3-42. Mean (± standard deviation [SD]) Daily Beverage Intakes Reported on Beverage Frequency Questionnaire and 3-Day Food and Beverage Diaries**

| | Age | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 months (*N* = 240) | | | 12 months (*N* = 192) | | | 3 years (*N* = 129) | | | 5 years (*N* = 112) | | |
| | Questionnaire | Diary | | Questionnaire | Diary | | Questionnaire | Diary | | Questionnaire | Diary | |
| Beverage | mL/day[a] | | %[b] | mL/day[a] | | %[b] | mL/day[a] | | %[b] | mL/day[a] | | %[b] |
| Human milk | 204 ± 373 | 195 ± 358 | 28.0 | 9 ± 21 | 56 ± 225 | 12.6 | NA[c] | NA | - | NA | NA | - |
| Infant formula | 609 ± 387 | 603 ± 364 | 85.8 | 180 ± 290 | 139 ± 251 | 37.0 | NA | NA | - | NA | NA | - |
| Cow's milk | 24 ± 124 | 24 ± 124 | 6.7 | 429 ± 349 | 408 ± 331 | 90.4 | 316 ± 216 | 358 ± 216 | 100 | 319 ± 198 | 325 ± 177 | 98.2 |
| Juice/juice drinks | 56 ± 124 | 33 ± 59 | 57.5 | 151 ± 136 | 106 ± 101 | 92.2 | 192 ± 169 | 198 ± 169 | 96.9 | 189 ± 169 | 180 ± 163 | 95.5 |
| Liquid soft drinks | 6 ± 68 | 0 ± 0 | 1.3 | 9 ± 30 | 3 ± 15 | 20.9 | 62 ± 71 | 74 ± 101 | 74.2 | 74 ± 95 | 101 ± 121 | 82.1 |
| Powdered soft drinks | 0 ± 18 | 0 ± 0 | 0.4 | 12 ± 47 | 3 ± 18 | 10.5 | 62 ± 115 | 47 ± 101 | 51.2 | 74 ± 124 | 47 ± 95 | 52.7 |
| Water | 44 ± 80 | 30 ± 53 | 61.7 | 127 ± 136 | 80 ± 109 | 84.9 | 177 ± 204 | 136 ± 177 | 95.3 | 240 ± 242 | 169 ± 183 | 99.1 |
| Total | 940 ± 319 | 896 ± 195 | 100 | 905 ± 387 | 804 ± 284 | 100 | 795 ± 355 | 816 ± 299 | 100 | 896 ± 399 | 819 ± 302 | 100 |

[a] Mean standard deviation of all subjects. Converted from ounces/day; 1 fluid ounce = 29.57 mL.
[b] Percent of subjects consuming beverage on either questionnaire or diary.
*N* = Number of observations.
NA = Not applicable.

\- Indicates insufficient data to calculate percentage.

Source: Marshall et al. (2003b).

**Table 3-43. Consumption of Beverages by Infants and Toddlers (feeding infants and toddlers study)**

| | Age (months) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 4 to 6 months (*N* = 862) | | 7 to 8 months (*N* = 483) | | 9 to 11 months (*N* = 679) | | 12 to 14 months *N* = 374 | | 15 to 18 months *N* = 308 | | 19 to 24 months (*N* = 316) | |
| Beverage Category | Consumers %[a] | Mean ± SD mL/day[b] | Consumers %[a] | Mean ± SD mL/day[b] | Consumers %[a] | Mean ± SD mL/day[b] | Consumers %[a] | Mean ± SD mL/day[b] | Consumers %[a] | Mean ± SD mL/day[b] | Consumers %[a] | Mean ± SD mL/day[b] |
| Total milks[c] | 100 | 778 ± 257 | 100 | 692 ± 257 | 99.7 | 659 ± 284 | 98.2 | 618 ± 293 | 94.2 | 580 ± 305 | 93.4 | 532 ± 281 |
| 100% juice[d] | 21.3 | 121 ± 89 | 45.6 | 145 ± 109 | 55.3 | 160 ± 127 | 56.2 | 186 ± 145 | 57.8 | 275 ± 189 | 61.6 | 281 ± 189 |
| Fruit drinks[e] | 1.6 | 101 ± 77 | 7.1 | 98 ± 77 | 12.4 | 157 ± 139 | 29.1 | 231 ± 186 | 38.6 | 260 ± 231 | 42.6 | 305 ± 308 |
| Carbonated | 0.1 | 86 ± 0 | 1.1 | 6 ± 9 | 1.7 | 89 ± 92 | 4.5 | 115 ± 83 | 11.2 | 157 ± 106 | 11.9 | 163 ± 172 |
| Water | 33.7 | 163 ± 231 | 56.1 | 174 ± 219 | 66.9 | 210 ± 234 | 72.2 | 302 ± 316 | 74.0 | 313 ± 260 | 77.0 | 337 ± 245 |
| Other[f] | 1.4 | 201 ± 192 | 2.2 | 201 ± 219 | 3.5 | 169 ± 166 | 6.6 | 251 ± 378 | 12.2 | 198 ± 231 | 11.2 | 166 ± 248 |
| Total beverages | 100 | 863 ± 254 | 100 | 866 ± 310 | 100 | 911 ± 361 | 100 | 1,017 ± 399 | 100 | 1,079 ± 399 | 100 | 1,097 ± 482 |

[a] Weighted percentages, adjusted for over-sampling, nonresponse, and under-representation of some racial and ethnic groups.
[b] Amounts consumed only by those children who had a beverage from this beverage category. Converted from ounces/day; 1 fluid ounce = 29.57 mL.
[c] Includes human milk, infant formula, cow's milk, soy milk, and goat's milk.
[d] Fruit or vegetable juices with no added sweeteners.
[e] Includes beverages with less than 100% juice and often with added sweeteners; some were fortified with one or more nutrients.
[f] "Other" beverages category included tea, cocoa, and similar dry milk beverages, and electrolyte replacement beverages for infants.
*N* = Number of observations.

Source: Skinner et al. (2004).

**Table 3-44. Number of Drinking Water Events Per Day, Intake Per Event (mL/event), and Daily Intake (mL/day)[a]**

| | Summer | | | | Winter | | | |
|---|---|---|---|---|---|---|---|---|
| | | Events/day | mL[b]/event | mL[b]/day | | Events/day | mL[b]/event | mL[b]/day |
| Age and Sex | *N* | Mean ± SD | Mean ± SD | Mean ± SD | *N* | Mean ± SD | Mean ± SD | Mean ± SD |
| <2 years, M/F | 52 | 2.8 ± 2.2 | 145 ± 74 | 399 ± 417 | 86 | 3.0 ± 2.7 | 127 ± 74 | 393 ± 411 |
| 3 to 5 years, M/F | 77 | 3.9 ± 3.1 | 157 ± 74 | 583 ± 488 | 123 | 3.1 ± 2.1 | 142 ± 68 | 444 ± 384 |
| 6 to 12 years, M/F | 138 | 3.2 ± 2.3 | 207 ± 124 | 621 ± 515 | 211 | 3.1 ± 2.2 | 172 ± 151 | 544 ± 727 |
| 13 to 19 years, M | 52 | 3.6 ± 2.8 | 287 ± 225 | 1,011 ± 1,091 | 79 | 3.5 ± 3.2 | 260 ± 160 | 926 ± 1,431 |
| 13 to 19 years, F | 60 | 3.0 ± 2.1 | 263 ± 154 | 769 ± 943 | 91 | 4.2 ± 3.6 | 251 ± 195 | 1,091 ± 1,508 |
| 20 to 49 years, M | 313 | 4.1 ± 3.1 | 358 ± 260 | 1,431 ± 1,470 | 460 | 3.9 ± 3.4 | 290 ± 198 | 1,112 ± 1,221 |
| 20 to 49 years, F | 389 | 4.5 ± 3.4 | 296 ± 198 | 1,286 ± 1,230 | 618 | 4.3 ± 3.2 | 290 ± 207 | 1,209 ± 1,118 |
| >50 years, M | 259 | 4.5 ± 3.2 | 245 ± 130 | 1,076 ± 887 | 301 | 4.1 ± 2.6 | 245 ± 169 | 1,011 ± 831 |
| >50 years, F | 400 | 5.7 ± 3.4 | 237 ± 130 | 1,277 ± 872 | 489 | 5.1 ± 3.2 | 240 ± 93 | 1,183 ± 597 |
| Total | 1,740 | 4.4 ± 3.2 | 266 ± 186 | 1,141 ± 1,094 | 2,458 | 4.1 ± 3.1 | 248 ± 180 | 1,023 ± 1,059 |

[a] Based on a randomly selected day for each survey participant in the DWCS.
[b] Converted from ounces to mL by U.S. EPA by multiplying intake rates in ounces by 29.57 mL/ounce.
F = Female.
M = Male.
*N* = Number of participants.

Source: Barraj et al. (2009).

**Table 3-45. Mean (standard error [SE]) Total Daily Water Intake[a] for Older Adults**

| Water Intake | Young-Old (65 to <75 years) *N* = 1,105 | Middle-Old (75 to <85 years) *N* = 746 | Oldest-Old (85+ years) *N* = 203 |
|---|---|---|---|
| Total (g/day) | 2,905.8 (39.5) | 2,573.4 (44.1) | 2,275.8 (69.7) |
| Total (g/kg-day) | 38.4 (0.6) | 36.5 (0.6) | 35.7 (1.7) |

[a] Total water was defined as the sum of drinking water and water in beverages and foods.
*N* = Number of respondents.

Source: Zizza et al. (2009).

**Table 3-46. Per Capita[a] Estimates of Combined Direct and Indirect[b] Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Community Water (mL/day)**

| | | | Percentile | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Age | Sample Size | Mean | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| Birth to <1 month | 91 | 184 | - | - | - | 322 | 687* | 839* | 860* |
| 1 to <3 months | 253 | 227 | - | - | - | 456 | 804 | 896* | 1,165* |
| 3 to <6 months | 428 | 362 | - | - | 148 | 695 | 928 | 1,056 | 1,424* |
| 6 to <12 months | 714 | 360 | - | 17 | 218 | 628 | 885 | 1,055 | 1,511* |
| 1 to <2 years | 1,040 | 271 | - | 60 | 188 | 402 | 624 | 837 | 1,215* |
| 2 to <3 years | 1,056 | 317 | - | 78 | 246 | 479 | 683 | 877 | 1,364* |
| 3 to <6 years | 4,391 | 380 | 4 | 98 | 291 | 547 | 834 | 1,078 | 1,654 |
| 6 to <11 years | 1,670 | 447 | 22 | 133 | 350 | 648 | 980 | 1,235 | 1,870* |
| 11 to <16 years | 1,005 | 606 | 30 | 182 | 459 | 831 | 1,387 | 1,727 | 2,568* |
| 16 to <18 years | 363 | 731 | 16 | 194 | 490 | 961 | 1,562 | 1,983* | 3,720* |
| 18 to <21 years | 389 | 826 | 24 | 236 | 628 | 1,119 | 1,770 | 2,540* | 3,889* |
| >21 years | 9,207 | 1,104 | 69 | 422 | 928 | 1,530 | 2,230 | 2,811 | 4,523 |
| >65 years[c] | 2,170 | 1,127 | 16 | 545 | 1,067 | 1,601 | 2,139 | 3,551 | 3,661 |
| All ages | 20,607 | 926 | 30 | 263 | 710 | 1,311 | 2,014 | 2,544 | 4,242 |

[a] Includes all participants whether or not they ingested any water from the source during survey period.
[b] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[c] U.S. EPA (2004).
- = Zero.
* The sample size does not meet minimum requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

Source: Kahn (2008) (based on 1994−1996, 1998 USDA CSFII).

**Table 3-47. Per Capita[a] Estimates of Combined Direct and Indirect[b] Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Bottled Water (mL/day)**

| Age | Sample Size | Mean | Percentile | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| Birth to <1 month | 91 | 104 | - | - | - | 18 | 437* | 556* | 1,007* |
| 1 to <3 months | 253 | 106 | - | - | - | - | 541 | 771* | 1,056* |
| 3 to <6 months | 428 | 120 | - | - | - | - | 572 | 774 | 1,443* |
| 6 to <12 months | 714 | 120 | - | - | - | 53 | 506 | 761 | 1,284* |
| 1 to <2 years | 1,040 | 59 | - | - | - | - | 212 | 350 | 801* |
| 2 to <3 years | 1,056 | 76 | - | - | - | - | 280 | 494 | 1,001* |
| 3 to <6 years | 4,391 | 84 | - | - | - | - | 325 | 531 | 1,031* |
| 6 to <11 years | 1,670 | 84 | - | - | - | - | 330 | 532 | 1,079* |
| 11 to <16 years | 1,005 | 111 | - | - | - | - | 382 | 709 | 1,431* |
| 16 to <18 years | 363 | 109 | - | - | - | - | 426 | 680* | 1,605* |
| 18 to <21 years | 389 | 185 | - | - | - | - | 514 | 1,141* | 2,364* |
| >21 years | 9,207 | 189 | - | - | - | - | 754 | 1,183 | 2,129 |
| >65 years[c] | 2,170 | 136 | - | - | - | - | 591 | 1,038 | 1,957 |
| All ages | 20,607 | 163 | - | - | - | - | 592 | 1,059 | 2,007 |

[a] Includes all participants whether or not they ingested any water from the source during survey period.
[b] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[c] U.S. EPA (2004).
\- = Zero.
* The sample size does not meet minimum requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

Source: Kahn (2008) (Based on 1994−1996, 1998 USDA CSFII).

**Table 3-48. Per Capita[a] Estimates of Combined Direct and Indirect[b] Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Other Sources (mL/day)**

| Age | Sample Size | Mean | Percentile | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| Birth to <1 month | 91 | 13 | - | - | - | - | - | - | 393* |
| 1 to <3 months | 253 | 35 | - | - | - | - | - | 367* | 687* |
| 3 to <6 months | 428 | 45 | - | - | - | - | - | 365 | 938* |
| 6 to <12 months | 714 | 45 | - | - | - | - | 31 | 406 | 963* |
| 1 to <2 years | 1,040 | 22 | - | - | - | - | - | 118 | 482* |
| 2 to <3 years | 1,056 | 39 | - | - | - | - | 52 | 344 | 718* |
| 3 to <6 years | 4,391 | 43 | - | - | - | - | 58 | 343 | 830 |
| 6 to <11 years | 1,670 | 61 | - | - | - | - | 181 | 468 | 1,047* |
| 11 to <16 years | 1,005 | 102 | - | - | - | - | 344 | 786 | 1,698* |
| 16 to <18 years | 363 | 97 | - | - | - | - | 295 | 740* | 1,760* |
| 18 to <21 years | 389 | 47 | - | - | - | - | - | 246* | 1,047* |
| >21 years | 9,207 | 156 | - | - | - | - | 541 | 1,257 | 2,381 |
| >65 years[c] | 2,170 | 171 | - | - | - | - | 697 | 1,416 | 2,269 |
| All ages | 20,607 | 128 | - | - | - | - | 345 | 1,008 | 2,151 |

[a] Includes all participants whether or not they ingested any water from the source during survey period.
[b] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[c] U.S. EPA (2004).
\- = Zero.
* The sample size does not meet minimum requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

Source: Kahn (2008) (Based on 1994−1996, 1998 USDA CSFII).

**Table 3-49. Per Capita[a] Estimates of Combined Direct and Indirect[b] Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): All Sources (mL/day)**

| Age | Sample Size | Mean | Percentile | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| Birth to <1 month | 91 | 301 | - | - | 135 | 542 | 846* | 877* | 1,088* |
| 1 to <3 months | 253 | 368 | - | - | 267 | 694 | 889 | 1,020* | 1,265* |
| 3 to <6 months | 428 | 528 | - | 89 | 549 | 812 | 1,025 | 1,303 | 1,509* |
| 6 to <12 months | 714 | 530 | 37 | 181 | 505 | 771 | 1,029 | 1,278 | 1,690* |
| 1 to <2 years | 1,040 | 358 | 68 | 147 | 287 | 477 | 735 | 961 | 1,281* |
| 2 to <3 years | 1,056 | 437 | 104 | 211 | 372 | 588 | 825 | 999 | 1,662* |
| 3 to <6 years | 4,391 | 514 | 126 | 251 | 438 | 681 | 980 | 1,200 | 1,794 |
| 6 to <11 years | 1,670 | 600 | 169 | 304 | 503 | 803 | 1,130 | 1,409 | 2,167* |
| 11 to <16 years | 1,005 | 834 | 224 | 401 | 663 | 1,099 | 1,649 | 1,960 | 3,179* |
| 16 to <18 years | 363 | 964 | 236 | 387 | 742 | 1,273 | 1,842 | 2,344* | 3,854* |
| 18 to <21 years | 389 | 1,075 | 189 | 406 | 803 | 1,394 | 2,117 | 2,985* | 4,955* |
| >21 years | 9,207 | 1,466 | 500 | 828 | 1,278 | 1,871 | 2,553 | 3,195 | 5,174 |
| >65 years[c] | 2,170 | 1,451 | 651 | 935 | 1,344 | 1,832 | 2,323 | 2,708 | 3,747 |
| All ages | 20,607 | 1,233 | 285 | 573 | 1,038 | 1,633 | 2,341 | 2,908 | 4,805 |

[a] Includes all participants whether or not they ingested any water from the source during survey period.
[b] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[c] U.S. EPA (2004).
\- = Zero.
* The sample size does not meet minimum requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

Source: Kahn (2008) (Based on 1994−1996, 1998 USDA CSFII).

**Table 3-50. Per Capita[a] Estimates of Combined Direct and Indirect[b] Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Community Water (mL/kg-day)**

| Age | Sample size | Mean | Percentile | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| Birth to <1 month | 88 | 52 | - | - | - | 101 | 196* | 232* | 253* |
| 1 to <3 months | 245 | 48 | - | - | - | 91 | 151 | 205* | 310* |
| 3 to <6 months | 411 | 52 | - | - | 20 | 98 | 135 | 159 | 216* |
| 6 to <12 months | 678 | 41 | - | 2 | 24 | 71 | 102 | 126 | 185* |
| 1 to <2 years | 1,002 | 23 | - | 5 | 17 | 34 | 53 | 71 | 106* |
| 2 to <3 years | 994 | 23 | - | 6 | 17 | 33 | 50 | 60 | 113* |
| 3 to <6 years | 4,112 | 22 | - | 6 | 17 | 31 | 48 | 61 | 93 |
| 6 to <11 years | 1,553 | 16 | 1 | 5 | 12 | 22 | 34 | 43 | 71* |
| 11 to <16 years | 975 | 12 | 1 | 4 | 9 | 16 | 25 | 34 | 54* |
| 16 to <18 years | 360 | 11 | - | 3 | 8 | 15 | 23 | 31* | 55* |
| 18 to <21 years | 383 | 12 | 1 | 4 | 10 | 16 | 17 | 35* | 63* |
| >21 years | 9,049 | 15 | 1 | 6 | 12 | 21 | 31 | 39 | 62 |
| >65 years[c] | 2,139 | 16 | - | 7 | 15 | 23 | 31 | 37 | 52 |
| All ages | 19,850 | 16 | 1 | 5 | 12 | 21 | 32 | 43 | 75 |

[a] Includes all participants whether or not they ingested any water from the source during survey period.
[b] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[c] U.S. EPA (2004).
\- = Zero.
* The sample size does not meet minimum requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

Source: Kahn (2008) (Based on 1994−1996, 1998 USDA CSFII).

**Table 3-51. Per Capita[a] Estimates of Combined Direct and Indirect[b] Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Bottled Water (mL/kg-day)**

| Age | Sample Size | Mean | Percentile | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| Birth to <1 month | 88 | 33 | - | - | - | 6 | 131* | 243* | 324* |
| 1 to <3 months | 245 | 22 | - | - | - | - | 97 | 161* | 242* |
| 3 to <6 months | 411 | 16 | - | - | - | - | 74 | 117 | 193* |
| 6 to <12 months | 678 | 13 | - | - | - | 4 | 52 | 87 | 139* |
| 1 to <2 years | 1,002 | 5 | - | - | - | - | 18 | 28 | 67* |
| 2 to <3 years | 994 | 5 | - | - | - | - | 19 | 35 | 84* |
| 3 to <6 years | 4,112 | 5 | - | - | - | - | 18 | 30 | 59 |
| 6 to <11 years | 1,553 | 3 | - | - | - | - | 10 | 18 | 41* |
| 11 to <16 years | 975 | 2 | - | - | - | - | 8 | 14 | 26* |
| 16 to <18 years | 360 | 2 | - | - | - | - | 6 | 10* | 27* |
| 18 to <21 years | 383 | 3 | - | - | - | - | 8 | 19* | 34* |
| >21 years | 9,049 | 3 | - | - | - | - | 10 | 17 | 32 |
| >65 years[c] | 2,139 | 2 | - | - | - | - | 9 | 15 | 27 |
| All ages | 19,850 | 3 | - | - | - | - | 10 | 18 | 39 |

[a] Includes all participants whether or not they ingested any water from the source during survey period.
[b] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[c] U.S. EPA (2004).
\- = Zero.
* The sample size does not meet minimum requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

Source: Kahn (2008) (Based on 1994−1996, 1998 USDA CSFII).

**Table 3-52. Per Capita[a] Estimates of Combined Direct and Indirect[b] Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Other Sources (mL/kg-day)**

| Age | Sample Size | Mean | Percentile | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| Birth to <1 month | 88 | 4 | - | - | - | - | - | - | 122* |
| 1 to <3 months | 245 | 7 | - | - | - | - | - | 52* | 148* |
| 3 to <6 months | 411 | 7 | - | - | - | - | - | 55 | 155* |
| 6 to <12 months | 678 | 5 | - | - | - | - | 3 | 35 | 95* |
| 1 to <2 years | 1,002 | 2 | - | - | - | - | - | 11 | 45* |
| 2 to <3 years | 994 | 3 | - | - | - | - | 4 | 23 | 61* |
| 3 to <6 years | 4,112 | 2 | - | - | - | - | 3 | 19 | 48 |
| 6 to <11 years | 1,553 | 2 | - | - | - | - | 7 | 16 | 36* |
| 11 to <16 years | 975 | 2 | - | - | - | - | 7 | 14 | 34* |
| 16 to <18 years | 360 | 2 | - | - | - | - | 5 | 11* | 27* |
| 18 to <21 years | 383 | 1 | - | - | - | - | - | 4* | 14* |
| >21 years | 9,049 | 2 | - | - | - | - | 7 | 17 | 33 |
| >65 years[c] | 2,139 | 2 | - | - | - | - | 10 | 20 | 35 |
| All ages | 19,850 | 2 | - | - | - | - | 6 | 16 | 35 |

[a] Includes all participants whether or not they ingested any water from the source during survey period.
[b] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[c] U.S. EPA (2004).
\- = Zero.
* The sample size does not meet minimum requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

Source: Kahn (2008) (Based on 1994−1996, 1998 USDA CSFII).

**Table 3-53. Per Capita[a] Estimates of Combined Direct and Indirect[b] Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): All Sources (mL/kg-day)**

| Age | Sample Size | Mean | Percentile | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| Birth to <1 month | 88 | 89 | - | - | 21 | 168 | 235* | 269* | 338* |
| 1 to <3 months | 245 | 77 | - | - | 46 | 134 | 173 | 246* | 336* |
| 3 to <6 months | 411 | 75 | - | 9 | 73 | 118 | 156 | 186 | 225* |
| 6 to <12 months | 678 | 59 | 4 | 20 | 53 | 86 | 118 | 148 | 194* |
| 1 to <2 years | 1,002 | 31 | 6 | 13 | 24 | 39 | 63 | 85 | 122* |
| 2 to <3 years | 994 | 31 | 7 | 15 | 26 | 41 | 59 | 73 | 130* |
| 3 to <6 years | 4,112 | 29 | 7 | 14 | 25 | 38 | 56 | 69 | 102 |
| 6 to <11 years | 1,553 | 21 | 6 | 10 | 18 | 27 | 39 | 50 | 76* |
| 11 to <16 years | 975 | 16 | 4 | 8 | 13 | 20 | 31 | 39 | 60* |
| 16 to <18 years | 360 | 15 | 4 | 6 | 12 | 18 | 28 | 37* | 59* |
| 18 to <21 years | 383 | 16 | 3 | 6 | 12 | 21 | 32 | 41* | 73* |
| >21 years | 9,049 | 20 | 7 | 11 | 17 | 26 | 36 | 44 | 68 |
| >65 years[c] | 2,139 | 21 | 9 | 13 | 19 | 27 | 34 | 39 | 54 |
| All ages | 20,850 | 21 | 6 | 10 | 17 | 26 | 38 | 50 | 87 |

[a] Includes all participants whether or not they ingested any water from the source during survey period.
[b] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[c] U.S. EPA (2004).
\- = Zero.
* The sample size does not meet minimum requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

Source: Kahn (2008) (Based on 1994−1996, 1998 USDA CSFII).

**Table 3-54. Consumers-Only[a] Estimates of Combined Direct and Indirect[b] Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Community Water (mL/day)**

| Age | Sample Size | Mean | Percentile | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| Birth to <1 month | 40 | 470* | 32* | 215* | 482* | 692* | 849* | 858* | 919* |
| 1 to <3 months | 114 | 552 | 67* | 339 | 533 | 801 | 943* | 1,053* | 1,264* |
| 3 to <6 months | 281 | 556 | 44 | 180 | 561 | 837 | 1,021 | 1,171* | 1,440* |
| 6 to <12 months | 562 | 467 | 44 | 105 | 426 | 710 | 971 | 1,147 | 1,586* |
| 1 to <2 years | 916 | 308 | 43 | 107 | 229 | 428 | 674 | 893 | 1,248* |
| 2 to <3 years | 934 | 356 | 49 | 126 | 281 | 510 | 700 | 912 | 1,388* |
| 3 to <6 years | 3,960 | 417 | 57 | 146 | 336 | 581 | 867 | 1,099 | 1,684 |
| 6 to <11 years | 1,555 | 480 | 74 | 177 | 373 | 682 | 994 | 1,251 | 2,024* |
| 11 to <16 years | 937 | 652 | 106 | 236 | 487 | 873 | 1,432 | 1,744 | 2,589* |
| 16 to <18 years | 341 | 792 | 106 | 266 | 591 | 987 | 1,647 | 2,002* | 3,804* |
| 18 to <21 years | 364 | 895 | 114 | 295 | 674 | 1,174 | 1,860 | 2,565* | 3,917* |
| >21 years | 8,505 | 1,183 | 208 | 529 | 1,006 | 1,582 | 2,289 | 2,848 | 4,665 |
| >65 years[c] | 1,958 | 1,242 | 310 | 704 | 1,149 | 1,657 | 2,190 | 2,604 | 3,668 |
| All ages | 18,509 | 1,000 | 127 | 355 | 786 | 1,375 | 2,069 | 2,601 | 4,274 |

[a] Excludes individuals who did not ingest water from the source during the survey period.
[b] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[c] U.S. EPA (2004).
* The sample size does not meet minimum requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

Source: Kahn (2008) (Based on 1994−1996, 1998 USDA CSFII).

**Table 3-55. Consumers-Only[a] Estimates of Combined Direct and Indirect[b] Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Bottled Water (mL/day)**

| Age | Sample Size | Mean | Percentile | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| Birth to <1 month | 25 | - | - | - | - | - | - | - | - |
| 1 to <3 months | 64 | 450* | 31* | 62* | 329* | 743* | 886* | 1,045* | 1,562* |
| 3 to <6 months | 103 | 507 | 48* | 88 | 493 | 747 | 1,041* | 1,436* | 1,506* |
| 6 to <12 months | 200 | 425 | 47 | 114 | 353 | 630 | 945* | 1,103* | 1,413* |
| 1 to <2 years | 229 | 262 | 45 | 88 | 188 | 324 | 600 | 709* | 1,083* |
| 2 to <3 years | 232 | 352 | 57 | 116 | 241 | 471 | 736 | 977* | 1,665* |
| 3 to <6 years | 1,021 | 380 | 72 | 149 | 291 | 502 | 796 | 958 | 1,635* |
| 6 to <11 years | 332 | 430 | 88 | 168 | 350 | 557 | 850 | 1,081* | 1,823* |
| 11 to <16 years | 192 | 570 | 116* | 229 | 414 | 719 | 1,162* | 1,447* | 2,705* |
| 16 to <18 years | 63 | 615* | 85* | 198* | 446* | 779* | 1,365* | 1,613* | 2,639* |
| 18 to <21 years | 97 | 769 | 118* | 236 | 439 | 943 | 1,788* | 2,343* | 3,957* |
| >21 years | 1,893 | 831 | 167 | 354 | 650 | 1,071 | 1,773 | 2,093 | 3,505 |
| >65 years[c] | 302 | 910 | 234 | 465 | 785 | 1,182 | 1,766 | 2,074 | 2,548 |
| All ages | 4,451 | 736 | 118 | 266 | 532 | 975 | 1,567 | 1,964 | 3,312 |

[a] Excludes individuals who did not ingest water from the source during the survey period.
[b] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[c] U.S. EPA (2004).
\- Insufficient sample size to estimate mean and percentiles.
* The sample size does not meet minimum requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

Source: Kahn (2008) (Based on 1994−1996, 1998 USDA CSFII).

**Table 3-56. Consumers-Only[a] Estimates of Combined Direct and Indirect[b] Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Other Sources (mL/day)**

| Age | Sample Size | Mean | Percentile | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| Birth to <1 month | 3 | - | - | - | - | - | - | - | - |
| 1 to <3 months | 19 | - | - | - | - | - | - | - | - |
| 3 to <6 months | 38 | 562* | 59* | 179* | 412* | 739* | 983* | 1,205* | 2,264* |
| 6 to <12 months | 73 | 407* | 31* | 121* | 300* | 563* | 961* | 1,032* | 1,144* |
| 1 to <2 years | 98 | 262 | 18* | 65 | 143 | 371 | 602* | 899* | 1,204* |
| 2 to <3 years | 129 | 354 | 56* | 134 | 318 | 472 | 704* | 851* | 1,334* |
| 3 to <6 years | 533 | 396 | 59 | 148 | 314 | 546 | 796 | 1,019 | 1,543* |
| 6 to <11 years | 219 | 448 | 89 | 177 | 347 | 682 | 931 | 1,090* | 1,596* |
| 11 to <16 years | 151 | 687 | 171* | 296 | 482 | 947 | 1,356* | 1,839* | 2,891* |
| 16 to <18 years | 53 | 657* | 152* | 231* | 398* | 823* | 1,628* | 1,887* | 2,635* |
| 18 to <21 years | 33 | 569* | 103* | 142* | 371* | 806* | 1,160* | 1,959* | 1,962* |
| >21 years | 1,386 | 1,137 | 236 | 503 | 976 | 1,533 | 2,161 | 2,739 | 4,673 |
| >65 years[c] | 323 | 1,259 | 360 | 680 | 1,188 | 1,660 | 2,136 | 2,470 | 3,707* |
| All ages | 2,735 | 963 | 148 | 347 | 741 | 1,344 | 1,970 | 2,468 | 3,814 |

[a] Excludes individuals who did not ingest water from the source during the survey period.
[b] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[c] U.S. EPA (2004).
\- Insufficient sample size to estimate means and percentiles.
* The sample size does not meet minimum requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

Source: Kahn (2008) (Based on 1994−1996, 1998 USDA CSFII).

**Table 3-57. Consumers-Only[a] Estimates of Combined Direct and Indirect[b] Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): All Sources (mL/day)**

| Age | Sample Size | Mean | Percentile | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| Birth to <1 month | 58 | 511* | 51* | 266* | 520* | 713* | 858* | 986* | 1,274* |
| 1 to <3 months | 178 | 555 | 68* | 275 | 545 | 801 | 946* | 1,072* | 1,470* |
| 3 to <6 months | 363 | 629 | 69 | 384 | 612 | 851 | 1,064 | 1,330* | 1,522* |
| 6 to <12 months | 667 | 567 | 90 | 250 | 551 | 784 | 1,050 | 1,303 | 1,692* |
| 1 to <2 years | 1,017 | 366 | 84 | 159 | 294 | 481 | 735 | 978 | 1,281* |
| 2 to <3 years | 1,051 | 439 | 105 | 213 | 375 | 589 | 825 | 1,001 | 1,663* |
| 3 to <6 years | 4,350 | 518 | 134 | 255 | 442 | 682 | 980 | 1,206 | 1,796 |
| 6 to <11 years | 1,659 | 603 | 177 | 310 | 506 | 805 | 1,131 | 1,409 | 2,168* |
| 11 to <16 years | 1,000 | 837 | 229 | 404 | 665 | 1,105 | 1,649 | 1,961 | 3,184* |
| 16 to <18 years | 357 | 983 | 252 | 395 | 754 | 1,276 | 1,865 | 2,346* | 3,866* |
| 18 to <21 years | 383 | 1,094 | 219 | 424 | 823 | 1,397 | 2,144 | 3,002* | 4,967* |
| >21 years | 9,178 | 1,472 | 506 | 829 | 1,282 | 1,877 | 2,559 | 3,195 | 5,175 |
| >65 years[c] | 2,167 | 1,453 | 651 | 939 | 1,345 | 1,833 | 2,324 | 2,708 | 3,750 |
| All ages | 20,261 | 1,242 | 296 | 585 | 1,047 | 1,642 | 2,345 | 2,923 | 4,808 |

[a] Excludes individuals who did not ingest water from the source during the survey period.

[b] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.

[c] U.S. EPA (2004).

* The sample size does not meet minimum requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

Source: Kahn (2008) (Based on 1994−1996, 1998 USDA CSFII).

**Table 3-58. Consumers-Only[a] Estimates of Direct and Indirect[b] Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Community Water (mL/kg-day)**

| Age | Sample Size | Mean | Percentile | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| Birth to <1 month | 37 | 137* | 11* | 65* | 138* | 197* | 235* | 238* | 263* |
| 1 to <3 months | 108 | 119 | 12* | 71 | 107 | 151 | 228* | 285* | 345* |
| 3 to <6 months | 269 | 80 | 7 | 27 | 77 | 118 | 148 | 173* | 222* |
| 6 to <12 months | 534 | 53 | 5 | 12 | 47 | 81 | 112 | 129 | 186* |
| 1 to <2 years | 880 | 27 | 4 | 9 | 20 | 36 | 56 | 75 | 109* |
| 2 to <3 years | 879 | 26 | 4 | 9 | 21 | 36 | 52 | 62 | 121* |
| 3 to <6 years | 3,703 | 24 | 3 | 8 | 19 | 33 | 49 | 65 | 97 |
| 6 to <11 years | 1,439 | 17 | 3 | 6 | 13 | 23 | 35 | 45 | 72* |
| 11 to <16 years | 911 | 13 | 2 | 5 | 10 | 17 | 26 | 34 | 54* |
| 16 to <18 years | 339 | 12 | 1 | 4 | 9 | 16 | 24 | 32* | 58* |
| 18 to <21 years | 361 | 13 | 2 | 5 | 10 | 17 | 29 | 35* | 63* |
| >21 years | 8,355 | 16 | 3 | 7 | 13 | 22 | 32 | 39 | 63 |
| >65 years[c] | 1,927 | 18 | 5 | 10 | 16 | 24 | 32 | 37 | 53 |
| All ages | 17,815 | 17 | 3 | 7 | 13 | 22 | 33 | 44 | 77 |

[a] Excludes individuals who did not ingest water from the source during the survey period.
[b] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[c] U.S. EPA (2004).
* The sample size does not meet minimum requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

Source: Kahn (2008) (Based on 1994−1996, 1998 USDA CSFII).

**Table 3-59. Consumers-Only[a] Estimates of Direct and Indirect[b] Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Bottled Water (mL/kg-day)**

| Age | Sample Size | Mean | Percentile | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| Birth to <1 month | 25 | - | - | - | - | - | - | - | - |
| 1 to <3 months | 64 | 92* | 7* | 12* | 76* | 151* | 164* | 220* | 411* |
| 3 to <6 months | 95 | 72 | 6* | 15 | 69 | 100 | 149* | 184* | 213* |
| 6 to <12 months | 185 | 47 | 5* | 11 | 34 | 73 | 104* | 120* | 166* |
| 1 to <2 years | 216 | 22 | 5 | 8 | 16 | 27 | 49 | 66* | 103* |
| 2 to <3 years | 211 | 25 | 4 | 8 | 17 | 35 | 54 | 81* | 91* |
| 3 to <6 years | 946 | 21 | 4 | 8 | 16 | 29 | 45 | 57 | 90* |
| 6 to <11 years | 295 | 15 | 3 | 5 | 11 | 19 | 30 | 42* | 69* |
| 11 to <16 years | 180 | 11 | 2* | 4 | 8 | 14 | 24* | 27* | 44* |
| 16 to <18 years | 63 | 10* | 1* | 3* | 7* | 11* | 23* | 27* | 37* |
| 18 to <21 years | 93 | 11 | 2* | 3 | 6 | 14 | 27* | 30* | 54* |
| >21 years | 1,861 | 12 | 2 | 5 | 9 | 16 | 25 | 31 | 45 |
| >65 years[c] | 297 | 13 | 3 | 7 | 12 | 17 | 26 | 30 | 42* |
| All ages | 4,234 | 13 | 2 | 5 | 9 | 17 | 27 | 36 | 72 |

[a] Excludes individuals who did not ingest water from the source during the survey period.
[b] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[c] U.S. EPA (2004).
\- Insufficient sample size to estimate means and percentiles.
* The sample size does not meet minimum requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

Source: Kahn (2008) (Based on 1994−1996, 1998 USDA CSFII).

**Table 3-60. Consumers-Only[a] Estimates of Direct and Indirect[b] Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): Other Sources (mL/kg-day)**

| Age | Sample Size | Mean | Percentile | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| Birth to <1 month | 3 | - | - | - | - | - | - | - | - |
| 1 to <3 months | 19 | - | - | - | - | - | - | - | - |
| 3 to <6 months | 38 | 80* | 10* | 23* | 59* | 106* | 170* | 200* | 246* |
| 6 to <12 months | 68 | 44* | 4* | 10* | 33* | 65* | 95* | 106* | 147* |
| 1 to <2 years | 95 | 23 | 1* | 5 | 13 | 28 | 46* | 84* | 125* |
| 2 to <3 years | 124 | 26 | 4* | 10 | 21 | 34 | 55* | 66* | 114* |
| 3 to <6 years | 505 | 22 | 3 | 8 | 17 | 30 | 46 | 56 | 79* |
| 6 to <11 years | 208 | 16 | 3 | 6 | 12 | 23 | 32 | 39* | 62* |
| 11 to <16 years | 148 | 13 | 3* | 6 | 9 | 18 | 27* | 36* | 56* |
| 16 to <18 years | 52 | 10* | 2* | 4* | 7* | 12* | 24* | 29* | 43* |
| 18 to <21 years | 33 | 8* | 1* | 2* | 6* | 10* | 16* | 27* | 31* |
| >21 years | 1,365 | 15 | 3 | 6 | 13 | 21 | 30 | 39 | 58 |
| >65 years[c] | 322 | 18 | 5 | 9 | 16 | 24 | 31 | 37 | 50* |
| All ages | 2,657 | 16 | 3 | 6 | 12 | 21 | 32 | 41 | 67 |

[a] Excludes individuals who did not ingest water from the source during the survey period.
[b] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
[c] U.S. EPA (2004).
\- Indicates insufficient sample size to estimate distribution percentiles.
* The sample size does not meet minimum requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

Source: Kahn (2008) (Based on 1994−1996, 1998 USDA CSFII).

**Table 3-61. Consumers-Only[a] Estimates of Direct and Indirect[b] Water Ingestion Based on 1994−1996, 1998 Continuing Survey of Food Intake by Individuals (CSFII): All Sources (mL/kg-day)**

| Age | Sample Size | Mean | Percentile | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 25 | 50 | 75 | 90 | 95 | 99 |
| Birth to <1 month | 55 | 153* | 13* | 83* | 142* | 208* | 269* | 273* | 400* |
| 1 to <3 months | 172 | 116 | 12* | 50 | 107 | 161 | 216* | 291* | 361* |
| 3 to <6 months | 346 | 90 | 9 | 52 | 86 | 125 | 161 | 195* | 233* |
| 6 to <12 months | 631 | 63 | 10 | 27 | 58 | 88 | 120 | 152 | 198* |
| 1 to <2 years | 980 | 31 | 7 | 14 | 25 | 40 | 64 | 86 | 122* |
| 2 to <3 years | 989 | 31 | 7 | 15 | 27 | 41 | 59 | 73 | 130* |
| 3 to <6 years | 4,072 | 29 | 7 | 15 | 25 | 38 | 56 | 70 | 102* |
| 6 to <11 years | 1,542 | 21 | 6 | 10 | 18 | 27 | 39 | 50 | 76* |
| 11 to <16 years | 970 | 16 | 4 | 8 | 13 | 20 | 31 | 39 | 60* |
| 16 to <18 years | 354 | 15 | 4 | 7 | 12 | 18 | 29 | 37* | 60* |
| 18 to <21 years | 378 | 16 | 3 | 6 | 12 | 21 | 32 | 41* | 73* |
| >21 years | 9,020 | 20 | 7 | 11 | 17 | 26 | 36 | 44 | 68 |
| >65 years[c] | 2,136 | 21 | 9 | 13 | 19 | 27 | 34 | 39 | 54 |
| All ages | 19,509 | 21 | 6 | 11 | 17 | 26 | 38 | 50 | 87 |

[a] Excludes individuals who did not ingest water from the source during the survey period.

[b] Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.

[c] U.S. EPA (2004).

* The sample size does not meet minimum requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

Source: Kahn (2008) (Based on 1994−1996, 1998 USDA CSFII).

**Table 3-62. Two-Day Average[a] per Capita Drinking Water Intake: Pregnant and Lactating Women, and Women of Child-Bearing Age (13 to <50 years)**

| Population Group | *N* | Percent Consuming[b] | Mean | SE | Percentiles | | | | | | | | | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | |
| | | | | | g/day | | | | | | | | | |
| All water sources[c] | | | | | | | | | | | | | | |
| Pregnant | 426 | 98 | 1,539 | 76 | 0[d] | 251 | 450 | 813 | 1,291 | 2,200 | 2,872 | 3,203 | 4,120[d] | 5,719[d] |
| Lactating | 101 | 96 | 1,908 | 195 | 0[d] | 213[d] | 356[d] | 917 | 2,061 | 2,720 | 2,987[d] | 3,911[d] | 4,351[d] | 5,551[d] |
| Child-bearing age | 5,543 | 99 | 1,383 | 31 | 0 | 125 | 278 | 616 | 1,138 | 1,957 | 2,787 | 3,371 | 4,530 | 10,280[d] |
| Community water[e] | | | | | | | | | | | | | | |
| Pregnant | 426 | 63 | 731 | 81 | 0[d] | 0 | 0 | 0 | 364 | 1,091 | 2,138 | 2,859 | 3,558[d] | 5,162[d] |
| Lactating | 101 | 72 | 1,075 | 201 | 0[d] | 0[d] | 0[d] | 0 | 719 | 2,061 | 2,720[d] | 3,061[d] | 4,351[d] | 4,351[d] |
| Child-bearing age | 5,543 | 63 | 683 | 30 | 0 | 0 | 0 | 0 | 282 | 1,025 | 2,055 | 2,634 | 3,962 | 6,213[d] |
| Bottled water[f] | | | | | | | | | | | | | | |
| Pregnant | 426 | 60 | 545 | 55 | 0[d] | 0 | 0 | 0 | 259 | 974 | 1,466 | 1,896 | 2,605[d] | 3,792[d] |
| Lactating | 101 | 51 | 541 | 143 | 0[d] | 0[d] | 0[d] | 0 | 119 | 889 | 1,931[d] | 2,044[d] | 3,256[d] | 3,413[d] |
| Child-bearing age | 5,543 | 53 | 424 | 18 | 0 | 0 | 0 | 0 | 119 | 644 | 1,259 | 1,726 | 2,844 | 8,834[d] |
| Other water sources[f] | | | | | | | | | | | | | | |
| Pregnant | 426 | 35 | 263 | 66 | 0[d] | 0 | 0 | 0 | 0 | 186 | 702 | 1,777 | 2,693[d] | 5,719[d] |
| Lactating | 101 | 21 | 293 | 131 | 0[d] | 0[d] | 0[d] | 0 | 0 | 0 | 1,024[d] | 2,854[d] | 3,911[d] | 4,612[d] |
| Child-bearing age | 5,543 | 34 | 276 | 30 | 0 | 0 | 0 | 0 | 0 | 237 | 918 | 1,575 | 3,273 | 6,220[d] |
| | | | | | g/kg-day | | | | | | | | | |
| All water sources[c] | | | | | | | | | | | | | | |
| Pregnant | 426 | 98 | 21.1 | 1.1 | 0[d] | 3.1 | 5.9 | 10.7 | 16.7 | 28.9 | 41.6 | 49.0 | 63.9[d] | 94.1[d] |
| Lactating | 101 | 96 | 28.8 | 2.8 | 0[d] | 3.9[d] | 6.9[d] | 14.1 | 29.8 | 46.2 | 48.3[d] | 51.3[d] | 65.3[d] | 75.0[d] |
| Child-bearing age | 5,543 | 99 | 19.7 | 0.47 | 0 | 1.8 | 4.0 | 8.5 | 16.1 | 27.5 | 41.1 | 48.4 | 67.1 | 178.8[d] |

**Table 3-62. Two-Day Average[a] per Capita Drinking Water Intake: Pregnant and Lactating Women, and Women of Child-Bearing Age (13 to <50 years) (Continued)**

| Population Group | *N* | Percent Consuming[b] | Mean | SE | Percentiles | | | | | | | | | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | |
| Community water[e] | | | | | | | | | | | | | | |
| Pregnant | 426 | 63 | 9.8 | 1.1 | 0[d] | 0 | 0 | 0 | 5.0 | 15.6 | 30.5 | 37.3 | 44.0[d] | 92.2[d] |
| Lactating | 101 | 72 | 16.5 | 3.3 | 0[d] | 0[d] | 0[d] | 0 | 11.6 | 29.8 | 46.2[d] | 47.0[d] | 65.3[d] | 65.3[d] |
| Child-bearing age | 5,543 | 63 | 9.8 | 0.46 | 0 | 0 | 0 | 0 | 4.1 | 15.0 | 29.1 | 38.2 | 60.1 | 110.1[d] |
| Bottled water[g] | | | | | | | | | | | | | | |
| Pregnant | 426 | 60 | 7.7 | 0.88 | 0[d] | 0 | 0 | 0 | 3.6 | 12.5 | 21.4 | 33.2 | 46.8[d] | 58.1[d] |
| Lactating | 101 | 51 | 7.8 | 1.8 | 0[d] | 0[d] | 0[d] | 0 | 1.6 | 12.0 | 26.4[d] | 33.4[d] | 46.0[d] | 51.0[d] |
| Child-bearing age | 5,543 | 53 | 6.0 | 0.27 | 0 | 0 | 0 | 0 | 1.7 | 9.0 | 18.3 | 24.9 | 40.7 | 166.7[d] |
| Other water sources[f] | | | | | | | | | | | | | | |
| Pregnant | 426 | 35 | 3.6 | 0.88 | 0[d] | 0 | 0 | 0 | 0 | 2.6 | 11.2 | 25.2 | 36.6[d] | 94.1[d] |
| Lactating | 101 | 21 | 4.5 | 2.1 | 0[d] | 0[d] | 0[d] | 0 | 0 | 0 | 16.3[d] | 48.3[d] | 51.3[d] | 65.3[d] |
| Child-bearing age | 5,543 | 34 | 3.9 | 0.42 | 0 | 0 | 0 | 0 | 0 | 3.3 | 12.6 | 23.3 | 44.4 | 98.0[d] |

[a] Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/.

[b] Represents the percentage of individuals consuming at least once over the 2-day survey period.

[c] All water sources: water, community supply (direct and indirect water consumption); water, bottled (direct water consumption only); water, well or rain cistern (direct and indirect water consumption); water, spring (direct and indirect water consumption); water, don't drink tap water (direct and indirect water consumption); water, other (direct and indirect water consumption); water, don't know (direct and indirect water consumption).

[d] Estimates are less statistically reliable based on guidance published in the Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations (NCHS, 1993).

[e] Community water: water, community supply (direct and indirect water consumption).

[f] Other sources: water, well or rain cistern (direct and indirect water consumption); water, spring (direct and indirect water consumption); water, don't drink tap water (direct and indirect water consumption); water, other (direct and indirect water consumption); water, don't know (direct and indirect water consumption).

[g] Bottled water: water, bottled (direct water consumption only).

HNIS = Human Nutrition Information Service.

*N* = Sample size.

SE = Standard error.

Source: Based on EPA analysis of 2005−2010 NHANES using http://fcid.foodrisk.org/.

**Table 3-63. Two-Day Average[a] Consumer-Only Drinking Water Intake: Pregnant and Lactating Women, and Women of Child-Bearing Age (13 to <50 years)**

| Population Group | *N* | Mean | SE | Percentiles | | | | | | | | | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | |
| | | | | g/day | | | | | | | | | |
| All water sources[b] | | | | | | | | | | | | | |
| Pregnant | 423 | 1,564 | 82.4 | 70.7[c] | 318.3 | 522.7 | 836.7 | 1,324 | 2,200 | 2,894 | 3,213 | 4,120[c] | 5,719[c] |
| Lactating | 100 | 1,979 | 186.3 | 212.8[c] | 355.8[c] | 439.1[c] | 1,100 | 2,081 | 2,720 | 2,999[c] | 3,911[c] | 4,351[c] | 5,551[c] |
| Child-bearing age | 5,479 | 1,401 | 30.4 | 30.7 | 171.8 | 302.1 | 634.5 | 1,163 | 1,963 | 2,800 | 3,371 | 4,530 | 10,280[c] |
| Community water[d] | | | | | | | | | | | | | |
| Pregnant | 259 | 1,158 | 95.9 | 3.2[c] | 78.8[c] | 189.6 | 452.7 | 921.1 | 1,872 | 2,642 | 2,935[c] | 3,866[c] | 5,162[c] |
| Lactating | 68 | 1,495 | 232.5 | 46.7[c] | 189.4[c] | 266.4[c] | 476.1[c] | 1,078 | 2,388[c] | 2,720[c] | 3,061[c] | 4,351[c] | 4,351[c] |
| Child-bearing age | 3,365 | 1,082 | 28.6 | 8.2 | 54.0 | 133.3 | 347.9 | 786.8 | 1,599 | 2,430 | 2,956 | 4,355 | 6,213[c] |
| Bottled water[e] | | | | | | | | | | | | | |
| Pregnant | 255 | 913 | 61.0 | 59.3[c] | 118.5[c] | 192.5 | 362.2 | 859.1 | 1,250 | 1,745 | 2,184[c] | 2,670[c] | 3,792[c] |
| Lactating | 57 | 1,059 | 188.3 | 118.5[c] | 125.1[c] | 125.1[c] | 311.1[c] | 750.3 | 1,909[c] | 2,029[c] | 2,304[c] | 3,318[c] | 3,413[c] |
| Child-bearing age | 3,075 | 805 | 20.0 | 51.8 | 118.5 | 177.5 | 281.4 | 592.5 | 1,099 | 1,684 | 2,184 | 3,631 | 8,834[c] |
| Other water sources[f] | | | | | | | | | | | | | |
| Pregnant | 157 | 756 | 135.9 | 20.0[c] | 49.7[c] | 70.7[c] | 164.8 | 422.4 | 969.4 | 2,191[c] | 2,693[c] | 3,014[c] | 5,719[c] |
| Lactating | 29 | 1,382 | 451.5 | 69.3[c] | 137.3[c] | 212.8[c] | 229.9[c] | 1,024 | 2,854[c] | 3,911[c] | 3,911 | 4,612[c] | 4,612[c] |
| Child-bearing age | 2,012 | 804 | 56.9 | 5.5 | 34.0 | 71.6 | 212.8 | 502.8 | 1,040 | 2,013 | 2,771 | 4,124 | 6,220[c] |
| | | | | g/kg-day | | | | | | | | | |
| All water sources[b] | | | | | | | | | | | | | |
| Pregnant | 423 | 21.4 | 1.2 | 0.7[c] | 4.1 | 6.8 | 10.7 | 17.5 | 29.3 | 42.4 | 49.0 | 63.9[c] | 94.1[c] |
| Lactating | 100 | 29.8 | 2.7 | 3.9[c] | 6.7[c] | 7.0[c] | 17.0 | 30.0 | 46.2 | 48.3[c] | 51.3[c] | 65.3[c] | 75.0[c] |
| Child-bearing age | 5,479 | 20.0 | 0.5 | 0.5 | 2.3 | 4.3 | 8.9 | 16.3 | 27.7 | 41.1 | 48.8 | 67.1 | 178.8[c] |

**Table 3-63. Two-Day Average[a] Consumer-Only Drinking Water Intake: Pregnant and Lactating Women, and Women of Child-Bearing Age (13 to <50 years) (Continued)**

| Population Group | *N* | Mean | SE | Percentiles | | | | | | | | | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st | 5th | 10th | 25th | 50th | 75th | 90th | 95th | 99th | |
| Community water[d] | | | | | | | | | | | | | |
| Pregnant | 259 | 15.5 | 1.2 | 0.1[c] | 0.9[c] | 2.5 | 6.2 | 12.0 | 23.3 | 33.3 | 37.7[c] | 44.4[c] | 92.2[c] |
| Lactating | 68 | 22.9 | 4.0 | 0.6[c] | 3.0[c] | 4.4[c] | 7.0[c] | 17.0 | 44.6[c] | 46.9[c] | 47.0[c] | 65.3[c] | 65.3[c] |
| Child-bearing age | 3,365 | 15.6 | 0.5 | 0.1 | 0.7 | 1.8 | 5.1 | 11.0 | 22.4 | 35.4 | 44.6 | 63.2 | 110.1[c] |
| Bottled water[e] | | | | | | | | | | | | | |
| Pregnant | 255 | 12.9 | 1.0 | 1.1[c] | 1.7[c] | 2.7 | 5.0 | 9.9 | 16.8 | 26.5 | 33.4[c] | 50.1[c] | 58.1[c] |
| Lactating | 57 | 15.2 | 2.3 | 1.6[c] | 2.2[c] | 2.2[c] | 4.0[c] | 12.0 | 23.5[c] | 33.4[c] | 40.7[c] | 46.0[c] | 51.0[c] |
| Child-bearing age | 3,075 | 11.4 | 0.3 | 0.7 | 1.7 | 2.3 | 4.1 | 8.4 | 15.0 | 24.0 | 31.9 | 48.5 | 166.7[c] |
| Other water sources[f] | | | | | | | | | | | | | |
| Pregnant | 157 | 10.3 | 1.8 | 0.2[c] | 0.6[c] | 1.4[c] | 2.2 | 5.7 | 12.2 | 29.3[c] | 36.6[c] | 37.8[c] | 94.1[c] |
| Lactating | 29 | 21.3 | 6.8 | 0.7[c] | 1.9[c] | 3.5[c] | 3.9[c] | 16.3 | 48.3[c] | 51.3[c] | 51.3[c] | 65.3[c] | 65.3[c] |
| Child-bearing age | 2,012 | 11.4 | 0.8 | 0.1 | 0.5 | 1.0 | 3.0 | 7.3 | 15.5 | 29.3 | 38.0 | 51.8 | 98.0[c] |

[a] Based on the average of 2 days of consumption reported for each NHANES respondent. If the respondent reported zero consumption on 1 of the 2 days and nonzero consumption on the other day, his/her average consumption would be the average of zero and nonzero consumption. Single day rates can be generated using http://fcid.foodrisk.org/.

[b] All Water Sources: water, community supply (direct and indirect water consumption); water, bottled (direct water consumption only); water, well or rain cistern (direct and indirect water consumption); water, spring (direct and indirect water consumption); water, don't drink tap water (direct and indirect water consumption); water, other (direct and indirect water consumption); water, don't know (direct and indirect water consumption).

[c] Estimates are less statistically reliable based on guidance published in the Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: HNIS/NCHS Analytical Working Group Recommendations (NCHS, 1993).

[d] Community water: water, community supply (direct and indirect water consumption).

[e] Bottled water: water, bottled (direct water consumption only).

[f] Other sources: water, well or rain cistern (direct and indirect water consumption); water, spring (direct and indirect water consumption); water, don't drink tap water (direct and indirect water consumption); water, other (direct and indirect water consumption); water, don't know (direct and indirect water consumption).

HNIS = Human Nutrition Information Service.
*N* = Sample size.
SE = Standard error.

Source: Based on U.S. EPA analysis of 2005−2010 NHANES using http://fcid.foodrisk.org/.

**Table 3-64. Total Fluid Intake of Women 15 to 49 Years Old**

| Reproductive Status[a] | Mean | Standard Deviation | Percentile Distribution | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 5 | 10 | 25 | 50 | 75 | 90 | 95 |
| mL/day | | | | | | | | | |
| Control | 1,940 | 686 | 995 | 1,172 | 1,467 | 1,835 | 2,305 | 2,831 | 3,186 |
| Pregnant | 2,076 | 743 | 1,085 | 1,236 | 1,553 | 1,928 | 2,444 | 3,028 | 3,475 |
| Lactating | 2,242 | 658 | 1,185 | 1,434 | 1,833 | 2,164 | 2,658 | 3,169 | 3,353 |
| mL/kg-day | | | | | | | | | |
| Control | 32.3 | 12.3 | 15.8 | 18.5 | 23.8 | 30.5 | 38.7 | 48.4 | 55.4 |
| Pregnant | 32.1 | 11.8 | 16.4 | 17.8 | 17.8 | 30.5 | 40.4 | 48.9 | 53.5 |
| Lactating | 37.0 | 11.6 | 19.6 | 21.8 | 21.8 | 35.1 | 45.0 | 53.7 | 59.2 |

[a] Number of observations: nonpregnant, nonlactating controls ($N$ = 6,201); pregnant ($N$ = 188); lactating ($N$ = 77).

Source: Ershow et al. (1991).

**Table 3-65. Total Tap Water Intake of Women 15 to 49 Years Old**

| Reproductive Status[a] | Mean | Standard Deviation | Percentile Distribution | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 5 | 10 | 25 | 50 | 75 | 90 | 95 |
| mL/day | | | | | | | | | |
| Control | 1,157 | 635 | 310 | 453 | 709 | 1,065 | 1,503 | 1,983 | 2,310 |
| Pregnant | 1,189 | 699 | 274 | 419 | 713 | 1,063 | 1,501 | 2,191 | 2,424 |
| Lactating | 1,310 | 591 | 430 | 612 | 855 | 1,330 | 1,693 | 1,945 | 2,191 |
| mL/kg-day | | | | | | | | | |
| Control | 19.1 | 10.8 | 5.2 | 7.5 | 11.7 | 17.3 | 24.4 | 33.1 | 39.1 |
| Pregnant | 18.3 | 10.4 | 4.9 | 5.9 | 10.7 | 16.4 | 23.8 | 34.5 | 39.6 |
| Lactating | 21.4 | 9.8 | 7.4 | 9.8 | 14.8 | 20.5 | 26.8 | 35.1 | 37.4 |
| Fraction of daily fluid intake that is tap water (%) | | | | | | | | | |
| Control | 57.2 | 18.0 | 24.6 | 32.2 | 45.9 | 59.0 | 70.7 | 79.0 | 83.2 |
| Pregnant | 54.1 | 18.2 | 21.2 | 27.9 | 42.9 | 54.8 | 67.6 | 76.6 | 83.2 |
| Lactating | 57.0 | 15.8 | 27.4 | 38.0 | 49.5 | 58.1 | 65.9 | 76.4 | 80.5 |

[a] Number of observations: nonpregnant, nonlactating controls ($N$ = 6,201); pregnant ($N$ = 188); lactating ($N$ = 77).

Source: Ershow et al. (1991).

**Table 3-66. Total Fluid (mL/Day) Derived from Various Dietary Sources by Women Aged 15 to 49 Years[a]**

| Sources | Control Women | | | Pregnant Women | | | Lactating Women | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Percentile | | | Percentile | | | Percentile | |
| | Mean[b] | 50 | 95 | Mean[b] | 50 | 95 | Mean[b] | 50 | 95 |
| Drinking water | 583 | 480 | 1,440 | 695 | 640 | 1,760 | 677 | 560 | 1,600 |
| Milk and milk drinks | 162 | 107 | 523 | 308 | 273 | 749 | 306 | 285 | 820 |
| Other dairy products | 23 | 8 | 93 | 24 | 9 | 93 | 36 | 27 | 113 |
| Meats, poultry, fish, eggs | 126 | 114 | 263 | 121 | 104 | 252 | 133 | 117 | 256 |
| Legumes, nuts, and seeds | 13 | 0 | 77 | 18 | 0 | 88 | 15 | 0 | 72 |
| Grains and grain products | 90 | 65 | 257 | 98 | 69 | 246 | 119 | 82 | 387 |
| Citrus and noncitrus fruit juices | 57 | 0 | 234 | 69 | 0 | 280 | 64 | 0 | 219 |
| Fruits, potatoes, vegetables, tomatoes | 198 | 171 | 459 | 212 | 185 | 486 | 245 | 197 | 582 |
| Fats, oils, dressings, sugars, sweets | 9 | 3 | 41 | 9 | 3 | 40 | 10 | 6 | 50 |
| Tea | 148 | 0 | 630 | 132 | 0 | 617 | 253 | 77 | 848 |
| Coffee and coffee substitutes | 291 | 159 | 1,045 | 197 | 0 | 955 | 205 | 80 | 955 |
| Carbonated soft drinks[c] | 174 | 110 | 590 | 130 | 73 | 464 | 117 | 57 | 440 |
| Noncarbonated soft drinks[c] | 38 | 0 | 222 | 48 | 0 | 257 | 38 | 0 | 222 |
| Beer | 17 | 0 | 110 | 7 | 0 | 0 | 17 | 0 | 147 |
| Wine spirits, liqueurs, mixed drinks | 10 | 0 | 66 | 5 | 0 | 25 | 6 | 0 | 59 |
| All sources | 1,940 | NA | NA | 2,076 | NA | NA | 2,242 | NA | NA |

[a] Number of observations: nonpregnant, nonlactating controls (*N* = 6,201); pregnant (*N* = 188); lactating (*N* = 77).
[b] Individual means may not add to all-sources total due to rounding.
[c] Includes regular, low-calorie, and noncalorie soft drinks.
NA = Not appropriate to sum the columns for the 50th and 95th percentiles of intake.

Source: Ershow et al. (1991).

**Table 3-67. Daily Water Intake for Men and Pregnant Women (L/day)**

| Category | *N* | Mean ± SD | Percentile | | | | |
|---|---|---|---|---|---|---|---|
| | | | 10 | 25 | 50 | 75 | 90 |
| Total water | | | | | | | |
| Pregnant women | 34 | 1.86 ± 0.73 | 1.17 | 1.45 | 1.75 | 2.08 | 2.33 |
| Men | 33 | 1.68 ± 0.70 | 0.70 | 1.34 | 1.59 | 2.08 | 2.39 |
| Tap water[a] | | | | | | | |
| Pregnant women | 34 | 0.78 ± 0.51 | 0.20 | 0.43 | 0.62 | 1.12 | 1.39 |
| Men | 33 | 0.78 ± 0.51 | 0.25 | 0.34 | 0.81 | 1.10 | 1.23 |
| Cold tap water at home[b] | | | | | | | |
| All pregnant women | 34 | 0.37 ± 0.40 | 0 | 0.02 | 0.26 | 0.55 | 0.97 |
| Employed full time | 18 | 0.28 ± 0.30 | 0 | 0.04 | 0.15 | 0.53 | 0.60 |
| Employed part time or less | 16 | 0.47 ± 0.48 | 0 | 0.01 | 0.42 | 0.73 | 1.04 |
| All men | 33 | 0.29 ± 0.35 | 0 | 0 | 0.15 | 0.51 | 0.69 |

[a] Filtered tap water excluded.
[b] Filtered tap water and iced tea excluded.
*N* = Number of subjects.

Source: Shimokura et al. (1998).

**Table 3-68. Average Daily Tap Water Consumption (L/day) by Location, Temperature, and Beverage Type**

| Category | All Pregnant Women *N* = 34 | Pregnant Women Employed Full Time *N* = 18 | Pregnant Women Employed Part Time or Less *N* = 16 | All Men *N* = 33 |
|---|---|---|---|---|
| Consumption at home | | | | |
| Cold drinking water | 0.25 | 0.18 | 0.34 | 0.19 |
| Cold tap-water-based beverages | 0.11 | 0.10 | 0.13 | 0.10 |
| Total cold tap water | 0.37 | 0.28 | 0.47 | 0.29 |
| Hot tap water | 0.15 | 0.11 | 0.20 | 0.14 |
| Total tap water | 0.52 | 0.38 | 0.67 | 0.43 |
| Consumption outside the home | | | | |
| Cold drinking water | 0.15 | 0.18 | 0.11 | 0.16 |
| Cold tap-water-based beverages | 0.04 | 0.06 | 0.02 | 0.03 |
| Total cold tap water | 0.19 | 0.23 | 0.14 | 0.18 |
| Hot tap water | 0.08 | 0.12 | 0.02 | 0.17 |
| Total tap water | 0.26 | 0.36 | 0.16 | 0.35 |
| Total cold tap water | 0.56 | 0.51 | 0.61 | 0.47 |
| Total hot tap water | 0.23 | 0.23 | 0.22 | 0.31 |
| Total tap water | 0.78 | 0.74 | 0.83 | 0.78 |

*N* = Number of subjects.

Source: Shimokura et al. (1998).

**Table 3-69. Water Ingestion Rates by Pregnancy Status (L/day) and Source Location**

| | | | | Percentiles | | | | | Percentiles | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Characteristic | Mean | SD | 25th | 50th | 75th | Mean | SD | 25th | 50th | 75th |
| | | Pregnant (*N* = 71) | | | | | Not pregnant (*N* = 43) | | | | |
| Home | Cold tap water | 1.8 | 1.4 | 0.9 | 1.4 | 2.3 | 1.3 | 1.0 | 0.5 | 0.9 | 2.0 |
| | Cold tap-water-based beverages | 1.0 | 0.8 | 0.7 | 0.9 | 1.4 | 0.9 | 0.6 | 0.4 | 0.7 | 1.2 |
| | Hot tap-water-based beverages | 0.1 | 0.2 | 0.0 | 0.0 | 0.2 | 0.2 | 0.5 | 0.0 | 0.0 | 0.2 |
| | Total tap water intake | 2.9 | 1.8 | 1.8 | 2.3 | 3.7 | 2.4 | 1.2 | 1.5 | 2.3 | 2.9 |
| | | Pregnant (*N* = 36) | | | | | Not pregnant (*N* = 23) | | | | |
| Work | Cold tap water | 0.7 | 0.6 | 0.2 | 0.4 | 1.3 | 1.0 | 1.2 | 0.4 | 0.7 | 1.4 |
| | Cold tap-water-based beverages | 0.1 | 0.3 | 0.0 | 0.0 | 0.0 | 0.1 | 0.3 | 0.0 | 0.0 | 0.0 |
| | Hot tap-water-based beverages | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 |
| | Total tap water intake | 0.9 | 0.7 | 0.4 | 0.7 | 1.4 | 1.2 | 1.2 | 0.5 | 0.9 | 1.4 |
| | | Pregnant (*N* = 71) | | | | | Not pregnant (*N* = 43) | | | | |
| Total | Cold tap water | 2.1 | 1.5 | 1.1 | 1.8 | 2.8 | 1.8 | 1.6 | 0.7 | 1.5 | 2.7 |
| | Cold tap-water-based beverages | 1.1 | 0.8 | 0.7 | 0.9 | 1.4 | 0.9 | 0.6 | 0.4 | 0.9 | 1.4 |
| | Hot tap-water-based beverages | 0.2 | 0.3 | 0.0 | 0.0 | 0.2 | 0.3 | 0.5 | 0.0 | 0.0 | 0.4 |
| | Total tap water intake | 3.4 | 1.8 | 2.0 | 3.0 | 4.3 | 3.0 | 1.7 | 1.8 | 2.7 | 4.1 |

*N* = Number of observations.

Source: Zender et al. (2001).

**Table 3-70. Principal Sources of Drinking Water at Home for Pregnant and Nonpregnant Women (%)**

| Source of Water | Pregnant | Nonpregnant |
|---|---|---|
| Tap water | 74.6 | 72.1 |
| Bottled water | 14.1 | 11.6 |
| Filtered water | 11.3 | 16.3 |

Source: Zender et al. (2001).

**Table 3-71. Total Tap Water and Bottled Water Intake by Pregnant Women (L/day)**

| Variables | Cold Tap Water | | Bottled Water | |
|---|---|---|---|---|
| | *N* | Mean (SD) | *N* | Mean (SD) |
| Demographics | | | | |
| Home | 2,293 | 1.3 (1.2) | [a] | [a] |
| Work | 2,295 | 0.4 (0.6) | [a] | [a] |
| Total | 2,293 | 1.7 (1.4) | 2,284 | 0.6 (0.9) |
| Season | | | | |
| Winter | 587 | 1.6 (1.3) | 584 | 0.6 (1.0) |
| Spring | 622 | 1.7 (1.4) | 622 | 0.6 (1.0) |
| Summer | 566 | 1.8 (1.6) | 560 | 0.6 (0.9) |
| Fall | 518 | 1.8 (1.5) | 518 | 0.5 (0.9) |
| Age at LMP | | | | |
| 17 to 25 | 852 | 1.6 (1.4) | 848 | 0.6 (1.0) |
| 26 to 30 | 714 | 1.8 (1.5) | 710 | 0.6 (1.0) |
| 31 to 35 | 539 | 1.7 (1.3) | 538 | 0.5 (0.8) |
| ≥36 | 188 | 1.8 (1.4) | 188 | 0.5 (0.9) |
| Education | | | | |
| ≤High school | 691 | 1.5 (1.5) | 687 | 0.6 (1.0) |
| Some college | 498 | 1.7 (1.5) | 496 | 0.6 (1.0) |
| ≥4-year college | 1,103 | 1.8 (1.3) | 1,100 | 0.5 (0.9) |
| Race/ethnicity | | | | |
| White, non-Hispanic | 1,276 | 1.8 (1.4) | 1,273 | 0.5 (0.9) |
| Black, non-Hispanic | 727 | 1.6 (1.5) | 722 | 0.6 (0.9) |
| Hispanic, any race | 204 | 1.1 (1.3) | 202 | 1.1 (1.2) |
| Other | 84 | 1.9 (1.5) | 85 | 0.5 (0.9) |
| Marital status | | | | |
| Single, never married | 719 | 1.6 (1.5) | 713 | 0.6 (1.0) |
| Married | 1,497 | 1.8 (1.4) | 1,494 | 0.5 (0.9) |
| Other | 76 | 1.7 (1.9) | 76 | 0.5 (0.9) |
| Annual income ($) | | | | |
| ≤40,000 | 967 | 1.6 (1.5) | 962 | 0.6 (1.0) |
| 40,000−80,000 | 730 | 1.8 (1.4) | 730 | 0.5 (0.9) |
| >80,000 | 501 | 1.7 (1.3) | 499 | 0.5 (0.9) |
| Employment | | | | |
| No | 681 | 1.7 (1.5) | 679 | 0.5 (0.9) |
| Yes | 1,611 | 1.7 (1.4) | 1,604 | 0.6 (0.9) |

**Table 3-71. Total Tap Water and Bottled Water Intake by Pregnant Women (L/day) (Continued)**

| Variables | Cold Tap Water | | Bottled Water | |
|---|---|---|---|---|
| | *N* | Mean (SD) | *N* | Mean (SD) |
| BMI | | | | |
| Low | 268 | 1.6 (1.3) | 267 | 0.6 (1.0) |
| Normal | 1,128 | 1.7 (1.4) | 1,123 | 0.5 (0.9) |
| Overweight | 288 | 1.7 (1.5) | 288 | 0.6 (0.9) |
| Obese | 542 | 1.8 (1.6) | 540 | 0.6 (1.0) |
| Diabetes | | | | |
| No diabetes | 2,221 | 1.7 (1.4) | 2,213 | 0.6 (0.9) |
| Regular diabetes | 17 | 2.6 (2.1) | 17 | 0.4 (0.8) |
| Gestational diabetes | 55 | 1.6 (1.6) | 54 | 0.6 (1.0) |
| Nausea during pregnancy | | | | |
| No | 387 | 1.6 (1.4) | 385 | 0.6 (1.0) |
| Yes | 1,904 | 1.7 (1.4) | 1,897 | 0.6 (0.9) |
| Pregnancy history | | | | |
| No prior pregnancy | 691 | 1.7 (1.4) | 685 | 0.6 (1.0) |
| Prior pregnancy with no SAB | 1,064 | 1.7 (1.4) | 1,063 | 0.5 (0.9) |
| Prior pregnancy with SAB | 538 | 1.8 (1.5) | 536 | 0.6 (1.0) |
| Caffeine | | | | |
| 0 mg/day | 578 | 1.8 (1.5) | 577 | 0.6 (1.0) |
| 1−150 mg/day | 522 | 1.6 (1.3) | 522 | 0.5 (0.8) |
| 151−300 mg/day | 433 | 1.6 (1.4) | 433 | 0.6 (0.9) |
| >300 mg/day | 760 | 1.7 (1.5) | 752 | 0.6 (1.0) |
| Vitamin use | | | | |
| No | 180 | 1.4 (1.4) | 176 | 0.5 (0.8) |
| Yes | 2,113 | 1.7 (1.4) | 2,108 | 0.6 (0.9) |
| Smoking | | | | |
| Nonsmoker | 2,164 | 1.7 (1.4) | 2,155 | 0.6 (0.9) |
| <10 cigarettes/day | 84 | 1.8 (1.5) | 84 | 0.8 (1.3) |
| ≥10 cigarettes/day | 45 | 1.8 (1.6) | 45 | 0.4 (0.7) |
| Alcohol use | | | | |
| No | 2,257 | 1.7 (1.4) | 2,247 | 0.6 (0.9) |
| Yes | 36 | 1.6 (1.2) | 37 | 0.6 (0.8) |
| Recreational exercise | | | | |
| No | 1,061 | 1.5 (1.4) | 1,054 | 0.6 (0.9) |
| Yes | 1,232 | 1.8 (1.4) | 1,230 | 0.6 (1.0) |

**Table 3-71. Total Tap Water and Bottled Water Intake by Pregnant Women (L/day) (Continued)**

| Variables | Cold Tap Water | | Bottled Water | |
|---|---|---|---|---|
| | *N* | Mean (SD) | *N* | Mean (SD) |
| Illicit drug use | | | | |
| No | 2,024 | 1.7 (1.4) | 2,017 | 0.6 (0.9) |
| Yes | 268 | 1.7 (1.5) | 266 | 0.6 (1.0) |

[a] Data are not reported in the source document.
BMI = Body mass index.
LMP = Age of last menstrual period.
*N* = Number of observations.
SAB = Spontaneous abortion.

Source: Forssén et al. (2007).

**Table 3-72. Percentage of Mean Water Intake Consumed as Unfiltered and Filtered Tap Water by Pregnant Women**

| | | Cold Unfiltered Tap Water | Cold Filtered Tap Water | Bottled Water |
|---|---|---|---|---|
| Variables | *N* | % | % | % |
| Total | 2,280 | 52 | 19 | 28 |
| Season | | | | |
| Winter | 583 | 52 | 19 | 29 |
| Spring | 621 | 53 | 19 | 28 |
| Summer | 559 | 50 | 20 | 29 |
| Fall | 517 | 54 | 19 | 26 |
| Age at LMP | | | | |
| ≤25 | 845 | 55 | 11 | 33 |
| 26−30 | 709 | 49 | 22 | 28 |
| 31−35 | 538 | 51 | 27 | 22 |
| ≥36 | 188 | 53 | 22 | 25 |
| Education | | | | |
| ≤High school | 685 | 56 | 8 | 34 |
| Some college | 495 | 53 | 16 | 30 |
| ≥4-year college | 1,099 | 49 | 27 | 23 |
| Race/ethnicity | | | | |
| White, non-Hispanic | 1,272 | 50 | 26 | 23 |
| Black, non-Hispanic | 720 | 60 | 9 | 30 |
| Hispanic, any race | 202 | 37 | 9 | 54 |
| Other | 84 | 48 | 27 | 25 |
| Marital status | | | | |
| Single, never married | 711 | 57 | 9 | 33 |
| Married | 1,492 | 50 | 25 | 25 |
| Other | 76 | 57 | 9 | 34 |
| Annual income ($) | | | | |
| ≤40,000 | 960 | 56 | 11 | 33 |
| 40,000−80,000 | 728 | 51 | 24 | 24 |
| >80,000 | 499 | 45 | 29 | 25 |
| Employment | | | | |
| No | 678 | 52 | 21 | 27 |
| Yes | 1,601 | 52 | 19 | 29 |

**Table 3-72. Percentage of Mean Water Intake Consumed as Unfiltered and Filtered Tap Water by Pregnant Women (Continued)**

| | | Cold Unfiltered Tap Water | Cold Filtered Tap Water | Bottled Water |
|---|---|---|---|---|
| Variables | *N* | % | % | % |
| BMI | | | | |
| Low | 266 | 50 | 21 | 29 |
| Normal | 1,121 | 51 | 22 | 27 |
| Overweight | 287 | 53 | 18 | 28 |
| Obese | 540 | 56 | 14 | 29 |
| Diabetes | | | | |
| No diabetes | 2,209 | 52 | 19 | 28 |
| Regular diabetes | 17 | 69 | 15 | 16 |
| Gestational diabetes | 54 | 50 | 22 | 27 |
| Nausea during pregnancy | | | | |
| No | 385 | 54 | 18 | 28 |
| Yes | 1,893 | 52 | 20 | 28 |
| Pregnancy history | | | | |
| No prior pregnancy | 685 | 48 | 21 | 31 |
| Prior pregnancy with no SAB | 1,060 | 54 | 18 | 27 |
| Prior pregnancy with SAB | 535 | 53 | 20 | 26 |
| Caffeine | | | | |
| 0 mg/day | 577 | 50 | 22 | 27 |
| 1−150 mg/day | 520 | 53 | 17 | 29 |
| 151−300 mg/day | 432 | 52 | 17 | 30 |
| >300 mg/day | 751 | 53 | 19 | 27 |
| Vitamin use | | | | |
| No | 176 | 57 | 8 | 34 |
| Yes | 2,104 | 52 | 20 | 28 |
| Smoking | | | | |
| Nonsmoker | 2,151 | 51 | 20 | 28 |
| <10 cigarettes/day | 84 | 60 | 10 | 28 |
| ≥10 cigarettes/day | 45 | 66 | 7 | 22 |
| Alcohol use | | | | |
| No | 2,244 | 52 | 19 | 28 |
| Yes | 36 | 58 | 19 | 23 |
| Recreational exercise | | | | |
| No | 1,053 | 54 | 14 | 31 |
| Yes | 1,227 | 51 | 24 | 26 |

**Table 3-72. Percentage of Mean Water Intake Consumed as Unfiltered and Filtered Tap Water by Pregnant Women (Continued)**

| | | Cold Unfiltered Tap Water | Cold Filtered Tap Water | Bottled Water |
|---|---|---|---|---|
| Variables | *N* | % | % | % |
| Illicit drug use | | | | |
| No | 2,013 | 51 | 20 | 28 |
| Yes | 266 | 56 | 12 | 31 |

BMI = body mass index.
LMP = Age of last menstrual period.
*N* = Number of observations.
SAB = spontaneous abortion.

Source: Forssén et al. (2007).

**Table 3-73. Intake Rates at Different Times During Pregnancy (L/day)**

| Source/Time Frame | *N* | Mean | 50th Percentile | 90th Percentile |
|---|---|---|---|---|
| Cold tap water | 1,981 | | | |
| Prepregnancy | | 1.48 | 1.24 | 3.31 |
| Early pregnancy | | 1.69 | 1.42 | 3.79 |
| Mid-pregnancy | | 1.84 | 1.66 | 3.79 |
| Hot tap water | 1,987 | | | |
| Prepregnancy | | 0.18 | 0.00 | 0.62 |
| Early pregnancy | | 0.16 | 0.00 | 0.41 |
| Mid-pregnancy | | 0.16 | 0.00 | 0.59 |
| Bottled water | 1,977 | | | |
| Early pregnancy | | 0.57 | 0.18 | 1.77 |
| Mid-pregnancy | | 0.59 | 0.09 | 2.07 |
| Total water | 1,968 | | | |
| Early pregnancy | | 2.43 | 2.10 | 4.26 |
| Mid-pregnancy | | 2.60 | 2.37 | 4.44 |

*N* = Number of observations.

Source: Forssén et al. (2009).

**Table 3-74. Frequency and Proportion of Women Reporting Changes in Water Intake between Early and Mid-Pregnancy**

| | No Change | | Increase | | Decrease | |
|---|---|---|---|---|---|---|
| Change (L/day) | *N* | % | *N* | % | *N* | % |
| Cold water | 388 | 19.6 | | | | |
| <1.0 | | | 508 | 25.6 | 423 | 21.3 |
| 1.0−2.5 | | | 280 | 14.1 | 220 | 11.1 |
| >2.5 | | | 92 | 4.6 | 70 | 3.5 |
| Total | | | 880 | 44.4 | 713 | 36.0 |
| Hot water | 1,228 | 61.8 | | | | |
| <1.0 | | | 163 | 8.2 | 148 | 7.4 |
| 1.0−2.5 | | | 194 | 9.8 | 182 | 9.2 |
| >2.5 | | | 37 | 1.9 | 35 | 1.8 |
| Total | | | 394 | 19.8 | 365 | 18.4 |
| Bottled water | 721 | 36.5 | | | | |
| <1.0 | | | 214 | 10.8 | 399 | 20.2 |
| 1.0−2.5 | | | 266 | 13.4 | 258 | 13.1 |
| >2.5 | | | 69 | 3.5 | 50 | 2.5 |
| Total | | | 549 | 27.8 | 707 | 35.8 |
| Total water | 76 | 3.9 | | | | |
| <1.0 | | | 449 | 22.8 | 409 | 20.8 |
| 1.0−2.5 | | | 480 | 24.4 | 355 | 18.0 |
| >2.5 | | | 110 | 5.6 | 89 | 5.4 |
| Total | | | 1,039 | 52.8 | 853 | 42.4 |

*N* = Number of observations.

Source: Forssén et al. (2009).

**Table 3-75. Per Capita Estimates of Direct and Indirect Water Intake from All Sources by Pregnant, Lactating, and Child-Bearing Age Women (mL/kg-day)**

| | | Mean | | | 90th Percentile | | | 95th Percentile | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 90% CI | | | 90% BI | | | 90% BI | |
| Women Categories | Sample Size | Estimate | Lower Bound | Upper Bound | Estimate | Lower Bound | Upper Bound | Estimate | Lower Bound | Upper Bound |
| Pregnant | 69 | 21* | 19* | 22* | 39* | 33* | 46* | 44* | 38* | 46* |
| Lactating | 40 | 21* | 15* | 28* | 53* | 44* | 55* | 55* | 52* | 57* |
| Nonpregnant, nonlactating ages 15 to 44 years | 2,166 | 19 | 19 | 20 | 35 | 35 | 36 | 36 | 46 | 47 |

* The sample size does not meet minimum reporting requirements to make statistically reliable estimates as described in the *Third Report on Nutrition Monitoring in the United States*, 1994−1996 (LSRO, 1995).

NOTE: Source of data: 1994−1996, 1998 USDA CSFII; estimates are based on 2-day averages; interval estimates may involve aggregation of variance estimation units when data are too sparse to support estimation of the variance; all estimates exclude commercial and biological water.

90% CI = 90% confidence intervals for estimated means; 90% BI = 90% bootstrap intervals for percentile estimates using bootstrap method with 1,000 replications.

Source: Kahn and Stralka (2008) (Based on CSFII 1994−1996 and 1998).

**Table 3-76. Per Capita Estimates of Direct and Indirect Water Intake from All Sources by Pregnant, Lactating, and Child-Bearing Age Women (mL/day)**

| | | Mean | | | 90th Percentile | | | 95th Percentile | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 90% CI | | | 90% BI | | | 90% BI | |
| Women Categories | Sample Size | Estimate | Lower Bound | Upper Bound | Estimate | Lower Bound | Upper Bound | Estimate | Lower Bound | Upper Bound |
| Pregnant | 70 | 1,318* | 1,199* | 1,436* | 2,336* | 1,851* | 3,690* | 2,674* | 2,167* | 3,690* |
| Lactating | 41 | 1,806* | 1,374* | 2,238* | 3,021* | 2,722* | 3,794* | 3,767* | 3,452* | 3,803* |
| Nonpregnant, nonlactating aged 15 to 44 | 2,221 | 1,243 | 1,193 | 1,292 | 2,336 | 2,222 | 2,488 | 2,937 | 2,774 | 3,211 |

* The sample size does not meet minimum reporting requirements to make statistically reliable estimates as described in the *Third Report on Nutrition Monitoring in the United States*, 1994−1996 (LSRO, 1995).

NOTE: Source of data: 1994−1996, 1998 USDA CSFII; estimates are based on 2-day averages; interval estimates may involve aggregation of variance estimation units when data are too sparse to support estimation of the variance; all estimates exclude commercial and biological water.

90% CI = 90% confidence intervals for estimated means; 90% BI = 90% bootstrap intervals for percentile estimates using bootstrap method with 1,000 replications.

Source: Kahn and Stralka (2008) (Based on CSFII 1994−1996 and 1998).

**Table 3-77. Per Capita Estimated Direct and Indirect Community Water Ingestion by Pregnant, Lactating, and Child-Bearing Age Women (mL/kg-day)**

| Women Categories | Sample Size | Mean | | | 90th Percentile | | | 95th Percentile | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 90% CI | | | 90% BI | | | 90% BI | |
| | | Estimate | Lower Bound | Upper Bound | Estimate | Lower Bound | Upper Bound | Estimate | Lower Bound | Upper Bound |
| Pregnant | 69 | 13* | 11* | 14* | 31* | 28* | 46* | 43* | 33* | 46* |
| Lactating | 40 | 21* | 15* | 28* | 53* | 44* | 55* | 55* | 52* | 57* |
| Nonpregnant, nonlactating ages 15 to 44 years | 2,166 | 14 | 14 | 15 | 31 | 30 | 32 | 38 | 36 | 39 |

* The sample size does not meet minimum reporting requirements to make statistically reliable estimates as described in the *Third Report on Nutrition Monitoring in the United States*, 1994−1996 (LSRO, 1995).

NOTE: Source of data: 1994−1996, 1998 USDA CSFII; estimates are based on 2-day averages; interval estimates may involve aggregation of variance estimation units when data are too sparse to support estimation of the variance; all estimates exclude commercial and biological water.

90% CI = 90% confidence intervals for estimated means; 90% BI = 90% bootstrap intervals for percentile estimates using bootstrap method with 1,000 replications.

Source: Kahn and Stralka (2008) (Based on CSFII 1994−1996 and 1998).

**Table 3-78. Per Capita Estimated Direct and Indirect Community Water Ingestion by Pregnant, Lactating, and Child-Bearing Age Women (mL/day)**

| Women Categories | Sample Size | Mean | | | 90th Percentile | | | 95th Percentile | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 90% CI | | | 90% BI | | | 90% BI | |
| | | Estimate | Lower Bound | Upper Bound | Estimate | Lower Bound | Upper Bound | Estimate | Lower Bound | Upper Bound |
| Pregnant | 70 | 819* | 669* | 969* | 1,815* | 1,479* | 2,808* | 2,503* | 2,167* | 3,690* |
| Lactating | 41 | 1,379* | 1,021* | 1,737* | 2,872* | 2,722* | 3,452* | 3,434* | 2,987* | 3,803* |
| Nonpregnant, nonlactating ages 15 to 44 years | 2,221 | 916 | 882 | 951 | 1,953 | 1,854 | 2,065 | 2,575 | 2,403 | 2,908 |

* The sample size does not meet minimum reporting requirements to make statistically reliable estimates as described in the *Third Report on Nutrition Monitoring in the United States*, 1994−1996 (LSRO, 1995).

NOTE: Source of data: 1994−1996, 1998 USDA CSFII; estimates are based on 2-day averages; interval estimates may involve aggregation of variance estimation units when data are too sparse to support estimation of the variance; all estimates exclude commercial and biological water.

90% CI = 90% confidence intervals for estimated means; 90% BI = 90% bootstrap intervals for percentile estimates using bootstrap method with 1,000 replications.

Source: Kahn and Stralka (2008) (Based on CSFII 1994−1996 and 1998).

**Table 3-79. Consumers-Only Estimated Direct and Indirect Water Intake from All Sources by Pregnant, Lactating, and Child-Bearing Age Women (mL/kg-day)**

| | | Mean | | | 90th Percentile | | | 95th Percentile | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 90% CI | | | 90% BI | | | 90% BI | |
| Women Categories | Sample Size | Estimate | Lower Bound | Upper Bound | Estimate | Lower Bound | Upper Bound | Estimate | Lower Bound | Upper Bound |
| Pregnant | 69 | 21* | 19* | 22* | 39* | 33* | 46* | 44* | 38* | 46* |
| Lactating | 40 | 28* | 19* | 38* | 53* | 44* | 57* | 57* | 52* | 58* |
| Nonpregnant, nonlactating ages 15 to 44 years | 2,149 | 19 | 19 | 20 | 35 | 34 | 37 | 46 | 42 | 48 |

* The sample size does not meet minimum reporting requirements to make statistically reliable estimates as described in the *Third Report on Nutrition Monitoring in the United States*, 1994−1996 (LSRO, 1995).

NOTE: Source of data: 1994−1996, 1998 USDA CSFII; estimates are based on 2-day averages; interval estimates may involve aggregation of variance estimation units when data are too sparse to support estimation of the variance; all estimates exclude commercial and biological water.

90% CI = 90% confidence intervals for estimated means; 90% BI = 90% bootstrap intervals for percentile estimates using bootstrap method with 1,000 replications.

Source: Kahn and Stralka (2008) (Based on CSFII 1994−1996 and 1998).

**Table 3-80. Consumers-Only Direct and Indirect Water Intake from All Sources by Pregnant, Lactating, and Child-Bearing Age Women (mL/day)**

| | | Mean | | | 90th Percentile | | | 95th Percentile | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 90% CI | | | 90% BI | | | 90% BI | |
| Women Categories | Sample Size | Estimate | Lower Bound | Upper Bound | Estimate | Lower Bound | Upper Bound | Estimate | Lower Bound | Upper Bound |
| Pregnant | 70 | 1,318* | 1,199* | 1,436* | 2,336* | 1,851* | 3,690* | 2,674* | 2,167* | 3,690* |
| Lactating | 41 | 1,806* | 1,374* | 2,238* | 3,021* | 2,722* | 3,794* | 3,767* | 3,452* | 3,803* |
| Nonpregnant, nonlactating ages 15 to 44 years | 2,203 | 1,252 | 1,202 | 1,303 | 2,338 | 2,256 | 2,404 | 2,941 | 2,834 | 3,179 |

* The sample size does not meet minimum reporting requirements to make statistically reliable estimates as described in the *Third Report on Nutrition Monitoring in the United States*, 1994−1996 (LSRO, 1995).

NOTE: Source of data: 1994−1996, 1998 USDA CSFII; estimates are based on 2-day averages; interval estimates may involve aggregation of variance estimation units when data are too sparse to support estimation of the variance; all estimates exclude commercial and biological water.

90% CI = 90% confidence intervals for estimated means; 90% BI = 90% bootstrap intervals for percentile estimates using bootstrap method with 1,000 replications.

Source: Kahn and Stralka (2008) (Based on CSFII 1994−1996 and 1998).

**Table 3-81. Consumers-Only Estimated Direct and Indirect Community Water Ingestion by Pregnant, Lactating, and Child-Bearing Age Women (mL/kg-day)**

| Women Categories | Sample Size | Mean | | | 90th Percentile | | | 95th Percentile | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 90% CI | | | 90% BI | | | 90% BI | |
| | | Estimate | Lower Bound | Upper Bound | Estimate | Lower Bound | Upper Bound | Estimate | Lower Bound | Upper Bound |
| Pregnant | 65 | 14* | 12* | 15* | 33* | 29* | 46* | 43* | 33* | 46* |
| Lactating | 33 | 26* | 18* | 18* | 54* | 44* | 55* | 55* | 53* | 57* |
| Nonpregnant, nonlactating ages 15 to 44 years | 2,028 | 15 | 14 | 16 | 32 | 31 | 33 | 38 | 36 | 42 |

* The sample size does not meet minimum reporting requirements to make statistically reliable estimates as described in the *Third Report on Nutrition Monitoring in the United States*, 1994−1996 (LSRO, 1995).

NOTE: Source of data: 1994−1996, 1998 USDA CSFII; estimates are based on 2-day averages; interval estimates may involve aggregation of variance estimation units when data are too sparse to support estimation of the variance; all estimates exclude commercial and biological water.

90% CI = 90% confidence intervals for estimated means; 90% BI = 90% bootstrap intervals for percentile estimates using bootstrap method with 1,000 replications.

Source: Kahn and Stralka (2008) (Based on CSFII 1994−1996 and 1998).

**Table 3-82. Consumers-Only Estimated Direct and Indirect Community Water Ingestion by Pregnant, Lactating, and Child-Bearing Age Women (mL/day)**

| Women Categories | Sample Size | Mean | | | 90th Percentile | | | 95th Percentile | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 90% CI | | | 90% BI | | | 90% BI | |
| | | Estimate | Lower Bound | Upper Bound | Estimate | Lower Bound | Upper Bound | Estimate | Lower Bound | Upper Bound |
| Pregnant | 65 | 872* | 728* | 1,016* | 1,844* | 1,776* | 3,690* | 2,589* | 2,167* | 3,690* |
| Lactating | 34 | 1,665* | 1,181* | 2,148* | 2,959* | 2,722* | 3,452* | 3,588* | 2,987* | 4,026* |
| Nonpregnant, nonlactating ages 15 to 44 years | 2,077 | 976 | 937 | 1,014 | 2,013 | 1,893 | 2,065 | 2,614 | 2,475 | 2,873 |

* The sample size does not meet minimum reporting requirements to make statistically reliable estimates as described in the *Third Report on Nutrition Monitoring in the United States*, 1994−1996 (LSRO, 1995).

NOTE: Source of data: 1994−1996, 1998 USDA CSFII; estimates are based on 2-day averages; interval estimates may involve aggregation of variance estimation units when data are too sparse to support estimation of the variance; all estimates exclude commercial and biological water.

90% CI = 90% confidence intervals for estimated means; 90% BI = 90% bootstrap intervals for percentile estimates using bootstrap method with 1,000 replications.

Source: Kahn and Stralka (2008) (Based on CSFII 1994−1996 and 1998).

**Table 3-83. Mean and 95th Percentile Community Water Intake among Formula-Fed Infants[a]**

| Age Group | Unweighted Sample Size[b] | Weighted Sample Size[b] | Indirect in Formula | | Total Direct and Indirect | |
|---|---|---|---|---|---|---|
| | | | Mean | 95th Percentile | Mean | 95th Percentile |
| | | | mL/day | | | |
| <1 month | 36 | 79,000 | 491[c] | 856[c] | 505[c] | 858[c] |
| 1 to <3 months | 96 | 236,000 | 572 | 963[c] | 627 | 1,096[c] |
| 3 to <6 months | 214 | 525,000 | 645 | 1,112[c] | 699 | 1,300[c] |
| 6 to <12 months | 324 | 823,000 | 573 | 1,192[c] | 691 | 1,350[c] |
| 1 to <2 years | 34 | 133,000 | 364 | 745[c] | 591[c] | 1,254[c] |
| | | | mL/kg-day | | | |
| <1 month | 34 | 79,000 | 143[c] | 240[c] | 146[c] | 240[c] |
| 1 to <3 months | 90 | 236,000 | 124 | 285[c] | 136 | 290[c] |
| 3 to <6 months | 205 | 525,000 | 93 | 171[c] | 101 | 186 |
| 6 to <12 months | 311 | 823,000 | 65 | 136[c] | 78 | 151[c] |
| 1 to <2 years | 32 | 133,000 | 38[c] | 82[c] | 60[c] | 119[c] |

[a] Formula-consumers only.

[b] Samples sizes for estimates in mL/kg-day are smaller than estimates in mL/day because body weight was not reported for some participants. Weighted samples sizes represent the number in each age group based on the unweighted number in the sample extrapolated to the overall U.S. population.

[c] The sample size does not meet the minimum reporting requirements as described in the *Third Report on Nutrition Monitoring in the United States* (LSRO, 1995).

Source: Kahn et al. (2013).

**Table 3-84. Tap Water Intake in Breast-Fed and Formula-Fed Infants and Mixed-Fed Young Children at Different Age Points**

| | | Tap Water Intake[b] (mL/day) | | | | | Tap Water Intake[b] (mL/kg-day) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | | | | | Total | | | | | | From Household[c] | | | From Manufacturing[d] | | |
| Age | *N*[a] | Mean | SD | Median | p95 | Max | Mean | SD | Median | p95 | Max | %[e] | Mean | SD | %[f] | Mean | SD | %[f] |
| Breast-fed | | | | | | | | | | | | | | | | | | |
| 1 year, total | 300 | 130 | 180 | 50 | 525 | 1,172 | 17 | 24** | 6 | 65 | 150 | 17 | 15 | 23** | 85 | 2.4 | 4.7** | 15 |
| 3 months | 111 | 67 | 167 | 0 | 493 | 746 | 10 | 25** | 0 | 74 | 125 | 10 | 10 | 25** | 97 | 0.3 | 1.9** | 3 |
| 6 months | 124 | 136 | 150 | 68 | 479 | 634 | 18 | 20** | 8 | 58 | 85 | 18 | 14 | 19** | 79 | 3.8 | 6.3* | 21 |
| 9 months | 47 | 254 | 218 | 207 | 656 | 1,172 | 30 | 27** | 23 | 77 | 150 | 28 | 26 | 27** | 87 | 3.7 | 3.4 | 13 |
| 12 months | 18 | 144 | 170 | 85 | 649 | 649 | 15 | 18** | 9 | 66 | 66 | 19 | 13 | 18** | 86 | 2.2 | 2.1 | 14 |
| Formula-fed | | | | | | | | | | | | | | | | | | |
| 1 year, total | 758 | 441 | 244 | 440 | 828 | 1,603 | 53 | 33 | 49 | 115 | 200 | 51 | 49 | 33 | 92 | 4.0 | 8.0 | 8 |
| 3 months | 78 | 662 | 154 | 673 | 874 | 994 | 107 | 23 | 107 | 147 | 159 | 93 | 103 | 28 | 97 | 3.4 | 17.9 | 3 |
| 6 months | 141 | 500 | 178 | 519 | 757 | 888 | 63 | 23 | 65 | 99 | 109 | 64 | 59 | 25 | 92 | 4.8 | 8.0 | 8 |
| 9 months | 242 | 434 | 236 | 406 | 839 | 1,579 | 49 | 27 | 45 | 94 | 200 | 50 | 44 | 27 | 91 | 4.5 | 6.3 | 9 |
| 12 months | 297 | 360 | 256 | 335 | 789 | 1,603 | 37 | 26 | 32 | 83 | 175 | 39 | 33 | 25 | 91 | 3.3 | 3.7 | 9 |

**Table 3-84. Tap Water Intake in Breast-Fed and Formula-Fed Infants and Mixed-Fed Young Children at Different Age Points (Continued)**

| | | Tap Water Intake[b] (mL/day) | | | | | Tap Water Intake[b] (mL/kg-day) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | | | | | Total | | | | | | From Household[c] | | | From Manufacturing[d] | | |
| Age | *N*[a] | Mean | SD | Median | p95 | Max | Mean | SD | Median | p95 | Max | %[e] | Mean | SD | %[f] | Mean | SD | %[f] |
| Mixed-fed | | | | | | | | | | | | | | | | | | |
| 1 to 3 years, total | 904 | 241 | 243 | 175 | 676 | 2,441 | 19 | 20 | 14 | 56 | 203 | 24 | 15 | 20 | 78 | 3.9 | 5.5 | 22 |
| 18 months | 277 | 280 | 264 | 205 | 828 | 1,881 | 25 | 23 | 18 | 70 | 183 | 28 | 22 | 23 | 88 | 3.0 | 4.1 | 12 |
| 24 months | 292 | 232 | 263 | 158 | 630 | 2,441 | 18 | 21 | 12 | 49 | 203 | 23 | 15 | 21 | 80 | 3.7 | 5.0 | 20 |
| 36 months | 335 | 217 | 199 | 164 | 578 | 1,544 | 14 | 13 | 11 | 36 | 103 | 22 | 9 | 12 | 66 | 4.9 | 6.6 | 34 |

[a] Numbers of 3-day diet records.
[b] Total tap water = tap water from the household and tap water from food manufacturing. Converted from g/day and g/kg-day; 1 g = 1 mL.
[c] Tap water from household = tap water from the household tap consumed directly as a beverage or used to prepare foods and beverages.
[d] Tap water from food = manufacturing tap water from the industrial food production used for the preparation of foods (bread, butter/margarine, tinned fruit, vegetables and legumes, ready to serve meals, commercial weaning food) and mixed beverages (lemonade, soft drinks).
[e] Mean as a percentage of total water.
[f] Mean as a percentage of total tap water.
* Significantly different from formula-fed infants, $p < 0.05$.
** Significantly different from formula-fed infants, $p < 0.0001$.
*N* = Number of observations.
p95 = 95th percentile.
SD = Standard deviation.

Source: Hilbig et al. (2002).

**Table 3-85. Water Intake for 2-Month-Old Infants (consumers-only)[a]**

| Type of Consumers | *N* | Mean | Percentiles | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 10th | 25th | 50th | 75th | 90th | 95th |
| | | | mL/day | | | | | |
| Total water | 393[b] | 521 | 57 | 372 | 515 | 713 | 926 | 1,036 |
| Tap water only | 232[b] | 564 | 102 | 394 | 552 | 757 | 959 | 1090 |
| Bottled water only | 134[b] | 504 | 71 | 382 | 489 | 684 | 838 | 995 |
| Formula-fed infants who consumed dry formula reconstituted with either bottled or tap water | 278[c] | 654 | 419 | 467 | 590 | 779 | 981 | 1,105 |
| | | | mL/kg-day | | | | | |
| Total water | 393[b] | 98 | 11 | 67 | 97 | 130 | 173 | 194 |
| Tap water only | 232[b] | 105 | 18 | 77 | 103 | 140 | 176 | 201 |
| Bottled water only | 134[b] | 94 | 14 | 73 | 92 | 122 | 168 | 194 |
| Formula-fed infants who consumed dry formula reconstituted with either bottled or tap water | 278[b] | 122 | 79 | 90 | 112 | 144 | 179 | 200 |

[a] Includes only infants who had some water ingestion.
[b] Includes 232 consuming only tap water, 134 consuming only bottled water, and 27 consuming both tap water and bottled water.
[c] Of the 393 infants who had some water ingestion, 278 consumed dry formula diluted with either tap water or bottled water; 167 of these infants had their formula diluted with tap water.
*N* = Number of observations.

Source: Levallois et al. (2008).

**Table 3-86. Water Intake at Various Activity Levels (L/hour)[a]**

| Room Temperature[b] (°F) | Activity Level | | | | | |
|---|---|---|---|---|---|---|
| | High (0.15 hp/man)[c] | | Medium (0.10 hp/man)[c] | | Low (0.05 hp/man)[c] | |
| | *N*[d] | Intake | *N* | Intake | *N* | Intake |
| 100 | - | - | - | - | 15 | 0.653 (0.75) |
| 95 | 18 | 0.540 (0.31) | 12 | 0.345 (0.59) | 6 | 0.50 (0.31) |
| 90 | 7 | 0.286 (0.26) | 7 | 0.385 (0.26) | 16 | 0.23 (0.20) |
| 85 | 7 | 0.218 (0.36) | 16 | 0.213 (0.20) | - | - |
| 80 | 16 | 0.222 (0.14) | - | - | - | - |

[a] Data expressed as mean intake with standard deviation in parentheses.
[b] Humidity = 80%; air velocity = 60 ft/minute.
[c] The symbol "hp" refers to horsepower.
[d] Number of subjects with continuous data.
- Data not reported in the source document.

Source: McNall and Schlegel (1968).

**Table 3-87. Planning Factors for Individual Tap Water Consumption**

| Environmental Condition | Recommended Planning Factor (gal/day)[a] | Recommended Planning Factor L/day[a,b] |
|---|---|---|
| Hot | 3.0[c] | 11.4 |
| Temperate | 1.5[d] | 5.7 |
| Cold | 2.0[e] | 7.6 |

[a] Based on a mixture of activities among the workforce as follows: 15% light work; 65% medium work; 20% heavy work. These factors apply to the conventional battlefield where no nuclear, biological, or chemical weapons are used.
[b] Converted from gal/day to L/day.
[c] This assumes 1 quart/12-hour rest period/man for perspiration losses and 1 quart/day-man for urination plus 6 quarts/12 hours of light work/man, 9 quarts/12 hours of moderate work/man, and 12 quarts/12 hours of heavy work/man.
[d] This assumes 1 quart/12-hour rest period/man for perspiration losses and 1 quart/day/man for urination plus 1 quart/12 hours of light work/man, 3 quarts/12 hours of moderate work/man, and 6 quarts/12 hours of heavy work/man.
[e] This assumes 1 quart/12-hour rest period/man for perspiration losses, 1 quart/day/man for urination, and 2 quarts/day/man for respiration losses plus 1 quart/12 hours of light work/man, 3 quarts/12 hours of moderate work/man, and 6 quarts/6 hours of heavy work/man.

Source: U.S. Army (1983, 1999).

**Table 3-88. Mean (± standard error [SE]) Fluid Intake (mL/kg-day) by Children Aged 1 to 10 Years, National Health and Nutrition Examination Survey (NHANES) III, 1988−1994**

| | Total Sample *N* = 7,925 | Sample with Temperature Information *N* = 3,869 | Sample without Temperature Information *N* = 4,056 |
|---|---|---|---|
| Total fluid | 84 ± 1.0 | 84 ± 1.0 | 85 ± 1.4 |
| Plain water | 27 ± 0.8 | 27 ± 1.0 | 26 ± 1.1 |
| Milk | 18 ± 0.3 | 18 ± 0.6 | 18 ± 0.4 |
| Carbonated drinks | 6 ± 0.2 | 5 ± 0.3 | 6 ± 0.3 |
| Juice | 12 ± 0.3 | 11 ± 0.6 | 12 ± 0.4 |

*N* = Number of observations.

Source: Sohn et al. (2001).

**Table 3-89. Estimated Mean (± standard error [SE]) Amount of Total Fluid and Plain Water Intake among Children[a] Aged 1 to 10 Years by Age, Sex, Race/Ethnicity, Poverty:Income Ratio, Region, and Urbanicity (National Health and Nutrition Examination Survey [NHANES] III, 1988−1994)**

| | | Total Fluid | | Plain Water | |
|---|---|---|---|---|---|
| | *N* | mL/day | mL/kg-day | mL/day | mL/kg-day |
| Age (years) | | | | | |
| 1 | 578 | 1,393 ± 31 | 124 ± 2.9 | 298 ± 19 | 26 ± 1.8 |
| 2 | 579 | 1,446 ± 31 | 107 ± 2.3 | 430 ± 26 | 32 ± 1.9 |
| 3 | 502 | 1,548 ± 75 | 100 ± 4.6 | 482 ± 27 | 31 ± 1.8 |
| 4 | 511 | 1,601 ± 41 | 91 ± 2.8 | 517 ± 23 | 29 ± 1.3 |
| 5 | 465 | 1,670 ± 54 | 84 ± 2.3 | 525 ± 36 | 26 ± 1.7 |
| 6 | 255 | 1,855 ± 125 | 81 ± 4.9 | 718 ± 118 | 31 ± 4.7 |
| 7 | 235 | 1,808 ± 66 | 71 ± 2.3 | 674 ± 46 | 26 ± 1.9 |
| 8 | 247 | 1,792 ± 37 | 61 ± 1.8 | 626 ± 37 | 21 ± 1.2 |
| 9 | 254 | 2,113 ± 78 | 65 ± 2.1 | 878 ± 59 | 26 ± 1.4 |
| 10 | 243 | 2,051 ± 97 | 58 ± 2.4 | 867 ± 74 | 24 ± 2.0 |
| Sex | | | | | |
| Male | 1,974 | 1,802 ± 30 | 86 ± 1.8 | 636 ± 32 | 29 ± 1.3 |
| Female | 1,895 | 1,664 ± 24 | 81 ± 1.5 | 579 ± 26 | 26 ± 1.0 |
| Race/ethnicity | | | | | |
| White | 736 | 1,653 ± 26 | 79 ± 1.8 | 552 ± 34 | 24 ± 0.3 |
| Black | 1,122 | 1,859 ± 42 | 88 ± 1.8 | 795 ± 36 | 36 ± 1.5 |
| Mexican American | 1,728 | 1,817 ± 25 | 89 ± 1.7 | 633 ± 23 | 29 ± 1.1 |
| Other | 283 | 1,813 ± 47 | 90 ± 4.2 | 565 ± 39 | 26 ± 1.7 |
| Poverty:income ratio[b] | | | | | |
| Low | 1,868 | 1,828 ± 32 | 93 ± 2.6 | 662 ± 27 | 32 ± 1.3 |
| Medium | 1,204 | 1,690 ± 31 | 80 ± 1.6 | 604 ± 35 | 26 ± 1.4 |
| High | 379 | 1,668 ± 54 | 76 ± 2.5 | 533 ± 41 | 22 ± 1.7 |
| Region[c,d] | | | | | |
| Northeast | 679 | 1,735 ± 31 | 87 ± 2.3 | 568 ± 52 | 26 ± 2.1 |
| Midwest | 699 | 1,734 ± 45 | 84 ± 1.5 | 640 ± 54 | 29 ± 1.8 |
| South | 869 | 1,739 ± 31 | 83 ± 2.2 | 613 ± 24 | 28 ± 1.3 |
| West | 1,622 | 737 ± 25 | 81 ± 1.7 | 624 ± 44 | 27 ± 1.9 |

**Table 3-89. Estimated Mean (± standard error [SE]) Amount of Total Fluid and Plain Water Intake among Children[a] Aged 1 to 10 Years by Age, Sex, Race/Ethnicity, Poverty:Income Ratio, Region, and Urbanicity (National Health and Nutrition Examination Survey [NHANES] III, 1988−1994) (Continued)**

| | | Total Fluid | | Plain Water | |
|---|---|---|---|---|---|
| | *N* | mL/day | mL/kg-day | mL/day | mL/kg-day |
| Urban/rural[d] | | | | | |
| Urban | 3,358 | 1,736 ± 18 | 84 ± 1.0 | 609 ± 29 | 27 ± 1.1 |
| Rural | 511 | 1,737 ± 19 | 84 ± 4.3 | 608 ± 20 | 28 ± 1.2 |
| Total | 3,869 | 1,737 ± 15 | 84 ± 1.1 | 609 ± 24 | 27 ± 1.0 |

[a] Children for whom temperature data were obtained.
[b] Based on ratio of household income to federal poverty threshold. Low: <1.300; medium: 1.301−3.500; high: >3.501.
[c] All variables except for region and urban/rural showed statistically significant differences for both total fluid and plain water intake by Bonferroni multiple comparison method.
[d] Northeast = Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont;
Midwest = Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin;
South = Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia;
West = Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming.
*N* = Number of observations.

Source: Sohn et al. (2001).

**Table 3-90. Daily Water Intake Based on Physical Activity Levels, Mean ± Standard Error (SE) g/day**

| Physical Activity Level | Plain Water[a] | Beverage Moisture[b] | Food Moisture[c] | Total Water[d] |
|---|---|---|---|---|
| Age 2−19 years ($N$ = 3,978)[e] | | | | |
| All | 583 ± 28 | 47 ± 1 | 437 ± 7 | 1,926 ± 36 |
| None | 379 ± 13 | 1,173 ± 194 | 417 ± 35 | 1,969 ± 244 |
| A little | 516 ± 79 | 842 ± 57 | 423 ± 27 | 1780 ± 108 |
| Some | 515 ± 39 | 881 ± 32 | 412 ± 18 | 1,808 ± 67 |
| A lot | 643 ± 31 | 917 ± 44 | 442 ± 10 | 2,003 ± 49 |
| Age 20+ years ($N$ = 4,112)[f] | | | | |
| All | 1,061 ± 52 | 1,539 ± 43 | 580 ± 12 | 3,179 ± 68 |
| Any leisure activity ≥10 minutes over previous month? | | | | |
| Yes | 1,112 ± 50 | 1,543 ± 44 | 587 ± 13 | 3,242 ± 72 |
| No | 933 ± 64 | 1,528 ± 53 | 561 ± 16 | 3,021 ± 69 |
| Average activity on usual day? | | | | |
| Mostly sitting | 998 ± 64 | 1,487 ± 65 | 584 ± 17 | 3,068 ± 58 |
| Mostly standing | 1,060 ± 61 | 1,471 ± 37 | 579 ± 8 | 3,110 ± 74 |
| Carry light loads or climb stairs | 1,100 ± 93 | 1,680 ± 87 | 577 ± 19 | 3,357 ± 109 |
| Heavy work or carry heavy loads | 1,142 ± 110 | 1,733 ± 55 | 582 ± 29 | 3,457 ± 123 |
| Age 20+ ($N$ = 2,691)[g] | | | | |
| All | 985 ± 39 | 1,418 ± 34 | 664 ± 14 | 3,066 ± 47 |
| MET score = 0 | 973 ± 74 | 1,295 ± 38 | 653 ± 19 | 2,920 ± 67 |
| MET score = Tertile 1 | 971 ± 38 | 1,325 ± 38 | 653 ± 13 | 2,949 ± 54 |
| MET score = Tertile 2 | 1,004 ± 81 | 1,617 ± 69 | 680 ± 29 | 3,302 ± 56 |
| MET score = Tertile 3 | 1,047 ± 81 | 1,806 ± 58 | 716 ± 25 | 3,568 ± 119 |

[a] Includes tap water, water from a cooler or drinking fountain, spring water, and noncarbonated bottled water.
[b] Includes moisture in beverages.
[c] Includes moisture in foods.
[d] Sum of plain water, beverage moisture, and food moisture.
[e] Kant and Graubard (2010); based on NHANES 2005−2006.
[f] Kant et al. (2009); based on NHANES 1999−2006.
[g] Yang and Chun (2014); based on NHANES 2005−2006.
$N$ = Number of individuals.

Source: Kant et al. (2009); Kant and Graubard (2010); Yang and Chun (2014).

**Table 3-91. Pool Water Ingestion by Swimmers**

| Study Group | Number of Participants | Average Water Ingestion Rate mL/45-minute interval | Average Water Ingestion Rate mL/hour[a] |
|---|---|---|---|
| Children <18 years old | 41 | 37 | 49 |
| Males <18 years old | 20 | 45 | 60 |
| Females <18 years old | 21 | 30 | 43 |
| Adults (>18 years) | 12 | 16 | 21 |
| Men | 4 | 22 | 29 |
| Women | 8 | 12 | 16 |

[a] Converted from mL/45-minute interval.

Source: Dufour et al. (2006).

**Table 3-92. Swimming Pool Water Ingestion Rates (mL/hour) by Swimmer Groups**

| Age Group | Sex | *N* | Geometric Mean | Confidence Intervals | 95th Percentile |
|---|---|---|---|---|---|
| Children 6−10 years | All | 66 | 24 | 17−33 | 96 |
| Teens 11−15 years | All | 121 | 24 | 19−30 | 152 |
| Adults 16+ years | All | 362 | 12 | 11−14 | 105 |
| | Female | 192 | 9 | 8−11 | 72 |
| | Male | 170 | 16 | 13−20 | 145 |

*N* = Number of study participants.

Source: Dufour et al. (2017); Dufour and Wymer (2017).

**Table 3-93. Water Ingested while Swimming (mL/hour)**

| | | | Percentiles | | | | |
|---|---|---|---|---|---|---|---|
| Age (years) | *N* | Mean | 25th | 50th | 75th | 90th | 95th |
| 6 to <11 | 66 | 38 | 15 | 25 | 53 | 77 | 96 |
| 11 to <16 | 121 | 44 | 11 | 29 | 48 | 103 | 152 |
| 16 to <21 | 84 | 33 | 9 | 19 | 41 | 74 | 105 |
| 6 to <21 | 271 | 39 | 11 | 25 | 47 | 87 | 137 |
| 21+ | 276 | 28 | 5 | 13 | 29 | 50 | 92 |

*N* = Number of study participants.

Source: Dufour (2017); based on data provided to L. Phillips by A. Dufour by personal communication, 6/21/2017.

**Table 3-94. Arithmetic Mean (maximum) Number of Dives per Diver and Volume of Water Ingested (mL/dive)**

| Divers and Locations | Percentage of Divers | Number of Dives | Volume of Water Ingested mL |
|---|---|---|---|
| Occupational divers (*N* = 35) | | | |
| Open sea | 57 | 24 (151) | 8.7 (25) |
| Coastal water, USD <1 km | 23 | 3.2 (36) | 9.7 (25) |
| Coastal water, USD >1 km | 20 | 1.8 (16) | 8.3 (25) |
| Coastal water, USD unknown | 51 | 16 (200) | 12 (100) |
| Open sea and coastal combined | - | - | 9.8 (100) |
| Fresh water, USD <1 km | 37 | 8.3 (76) | 5.5 (25) |
| Fresh water, USD >1 km | 37 | 16 (200) | 5.5 (25) |
| Fresh water, no USD | 37 | 16 (200) | 4.8 (25) |
| Fresh water, USD unknown | 77 | 45 (200) | 6.0 (25) |
| All fresh water combined | - | - | 5.7 (25) |
| Sports divers—ordinary mask (*N* = 482) | | | |
| Open sea | 26 | 2.1 (120) | 7.7 (100) |
| Coastal water | 78 | 14 (114) | 9.9 (190) |
| Open sea and coastal combined | - | - | 9.0 (190) |
| Fresh recreational water | 85 | 22 (159) | 13 (190) |
| Canals and rivers | 11 | 0.65 (62) | 3.4 (100) |
| City canals | 1.5 | 0.031 (4) | 2.8 (100) |
| Canals, rivers, city canals combined | - | - | 3.2 (100) |
| Swimming pools | 65 | 17 (134) | 20 (190) |
| Sports divers—full face mask (*N* = 482) | | | |
| Open sea | 0.21 | 0.012 (6) | 0.43 (2.8) |
| Coastal water | 1.0 | 0.10 (34) | 1.3 (15) |
| Fresh recreational water | 27 | 0.44 (80) | 1.3 (15) |
| Canals and rivers | 1.2 | 0.098 (13) | 0.47 (2.8) |
| City canals | 0.41 | 0.010 (3) | 0.31 (2.8) |
| All surface water combined | - | - | 0.81 (25) |
| Swimming pools | 2.3 | 0.21 (40) | 13 (190) |

*N* = Number of divers.
USD = Upstream sewage discharge.

Source: Schijven and de Roda Husman (2006).

**Table 3-95. Exposure Parameters for Swimmers in Swimming Pools, Fresh Water, and Seawater**

| Parameter | Adults | | | | Children <15 years | |
|---|---|---|---|---|---|---|
| | Men | | Women | | | |
| | Mean | 95% UCI | Mean | 95% UCI | Mean | 95% UCI |
| Swimming duration (min) | | | | | | |
| Swimming pool | 68 | 180 | 67 | 170 | 81 | 200 |
| Fresh water | 54 | 200 | 54 | 220 | 79 | 270 |
| Seawater | 45 | 160 | 41 | 180 | 65 | 240 |
| Volume water swallowed (mL) | | | | | | |
| Swimming pool | 34 | 170 | 23 | 110 | 51 | 200 |
| Fresh water | 27 | 140 | 18 | 86 | 37 | 170 |
| Seawater | 27 | 140 | 18 | 90 | 31 | 140 |

UCI = Upper confidence interval.

Source: Schets et al. (2011).

**Table 3-96. Estimated Water Ingestion during Water Recreation Activities (mL/hr)**

| Activity | Surface Water Study | | | | Swimming Pool Study | | | |
|---|---|---|---|---|---|---|---|---|
| | *N* | Median | Mean | UCL | *N* | Median | Mean | UCL |
| Limited Contact Scenarios | | | | | | | | |
| Boating | 316 | 2.1 | 3.7 | 11.2 | 0 | - | - | - |
| Canoeing | 766 | | | | 76 | | | |
| No capsize | | 2.2 | 3.8 | 11.4 | | 2.1 | 3.6 | 11.0 |
| With capsize | | 3.6 | 6.0 | 19.9 | | 3.9 | 6.6 | 22.4 |
| All activities | | 2.3 | 3.9 | 11.8 | | 2.6 | 4.4 | 14.1 |
| Fishing | 600 | 2.0 | 3.6 | 10.8 | 121 | 2.0 | 3.5 | 10.6 |
| Kayaking | 801 | | | | 104 | | | |
| No capsize | | 2.2 | 3.8 | 11.4 | | 2.1 | 3.6 | 10.9 |
| With capsize | | 2.9 | 5.0 | 16.5 | | 4.8 | 7.9 | 26.8 |
| All activities | | 2.3 | 3.8 | 11.6 | | 3.1 | 5.2 | 17.0 |
| Rowing | 222 | | | | 0 | | | |
| No capsize | | 2.3 | 3.9 | 11.8 | | - | - | - |
| With capsize | | 2.0 | 3.5 | 10.6 | | - | - | - |
| All activities | | 2.3 | 3.9 | 11.8 | | - | - | - |
| Wading/splashing | 0 | - | - | - | 112 | 2.2 | 3.7 | 11.2 |
| Walking | 0 | - | - | - | 23 | 2.0 | 3.5 | 10.6 |
| Full Contact Scenarios | | | | | | | | |
| Immersion | 0 | - | - | - | 112 | 3.2 | 5.1 | 15.3 |
| Swimming | 0 | - | - | - | 114 | 6.0 | 10.0 | 34.8 |
| TOTAL | 2,705 | | | | 662 | | | |

*N* = Number of participants.
UCL = Upper confidence limit (i.e., mean + 1.96 × SD).
- = No data.

Source: Dorevitch et al. (2011).

**Table 3-97. Pool Water Ingestion (mL/hr) by Activity and Age Group among Videotaped Participants**

| Groups | *N* | Mean | SD | Range |
|---|---|---|---|---|
| All swimmers | 35 | 13.7 | 24.0 | 0−105.5 |
| Adults | 19 | 3.5 | 11.7 | 0−50.9 |
| Children | 16 | 25.7 | 29.2 | 0.9−105.5 |
| Lap swimmers | 9 | 1.6 | 3.1 | 0.9−19 |
| Leisure swimmers | 26 | 17.8 | 26.6 | 0−105.5 |

*N* = Number of participants.

Source: Suppes et al. (2014).

**Table 3-98. Estimated Volume of Water Ingested per Swimming Event (mL/event)**

| | | | Percentiles | | | | |
|---|---|---|---|---|---|---|---|
| Age (years) | Mean | SD | 5th | 10th | 50th | 90th | 95th |
| All water types | | | | | | | |
| All ages | 44.4 | 93.1 | 1.0 | 2.0 | 16.0 | 104.7 | 174.0 |
| 6−12 | 63.2 | 83.4 | 2.8 | 5.5 | 36.0 | 150.0 | 213.0 |
| 13−18 | 63.7 | 83.4 | 1.6 | 3.1 | 27.0 | 156.0 | 254.0 |
| 19−34 | 29.0 | 69.4 | 0.7 | 1.3 | 9.7 | 66.0 | 116.0 |
| ≥35 | 29.9 | 82.6 | 0.7 | 1.1 | 9.0 | 64.0 | 118.0 |
| Fresh water | | | | | | | |
| All ages | 35.4 | 74.6 | 0.8 | 1.3 | 12.7 | 84.0 | 140.0 |
| 6−12 | 53.0 | 69.9 | 2.4 | 5.0 | 30.0 | 126.2 | 184.0 |
| 13−18 | 45.0 | 79.9 | 1.0 | 2.0 | 18.0 | 112.0 | 174.7 |
| 19−34 | 21.9 | 54.4 | 0.4 | 0.9 | 7.1 | 50.0 | 85.3 |
| ≥35 | 22.6 | 62.1 | 0.4 | 0.9 | 6.7 | 47.6 | 88.0 |
| Marine | | | | | | | |
| All ages | 48.3 | 99.3 | 1.2 | 2.0 | 18.0 | 116.0 | 186.7 |
| 6−12 | 67.7 | 88.5 | 3.0 | 6.0 | 39.3 | 160.0 | 220.0 |
| 13−18 | 71.4 | 115.5 | 2.0 | 4.0 | 32.0 | 174.7 | 280.0 |
| 19−34 | 32.8 | 76.3 | 0.7 | 1.3 | 11.1 | 76.0 | 126.0 |
| ≥35 | 32.3 | 88.1 | 0.7 | 1.3 | 9.8 | 70.5 | 121.3 |

Source: De-Florio-Barker et al. (2017).

**APPENDIX A**

**Table A-1. Comparison of Community Water Intake Estimates[a] 1994−1998 Continuing Survey of Food Intake by Individuals (CFSII), National Health and Nutrition Examination Survey (NHANES) 2003−2006, and NHANES 2005−2010**

| | CSFII 1994−1998[b] | | | NHANES 2003−2006[c] | | | NHANES 2005−2010[d] | | |
|---|---|---|---|---|---|---|---|---|---|
| Age Range | *N* | Mean | 95th | *N* | Mean | 95th | *N* | Mean | 95th |
| Per Capita (mL/day) | | | | | | | | | |
| Birth <1 month | 91 | 184 | ***839*** | 88 | ***239*** | ***851*** | 87 | 184 | ***951*** |
| 1 <3 months | 253 | 227 | ***896*** | 143 | ***282*** | ***962*** | 233 | 145 | ***905*** |
| 3 <6 months | 428 | 362 | 1,056 | 244 | ***373*** | ***925*** | 282 | 187 | ***981*** |
| 6 <12 months | 714 | 360 | 1,055 | 466 | 303 | ***866*** | 588 | 269 | 988 |
| 1 <2 years | 1,040 | 271 | 837 | 611 | 223 | ***760*** | 728 | 146 | 565 |
| 2 <3 years | 1,056 | 317 | 877 | 571 | 265 | ***861*** | 751 | 205 | 778 |
| 3 <6 years | 4,391 | 380 | 1,078 | 1,091 | 327 | 959 | 1,418 | 208 | 741 |
| 6 <11 years | 1,670 | 447 | 1,235 | 1,601 | 414 | 1,316 | 2,292 | 294 | 1,071 |
| 11 <16 years | 1,005 | 606 | 1,727 | 2,396 | 520 | 1,821 | 2,551 | 315 | 1,395 |
| 16 <21 years | 752 | 779 | 2,262 | 2,332 | 627 | 2,076 | 2,191 | 436 | 1,900 |
| >21 years | 9,207 | 1,104 | 2,811 | 8,673 | 1,043 | 2,958 | 13,552 | 859 | 2,732 |
| All | 20,607 | 926 | 2,544 | 18,216 | 869 | 2,717 | 24,673 | 711 | 2,641 |
| Per Capita (mL/kg-day) | | | | | | | | | |
| Birth <1 month | 88 | 52 | ***232*** | 88 | ***52*** | ***169*** | 87 | 42 | ***200*** |
| 1 <3 months | 245 | 48 | ***205*** | 143 | ***49*** | ***164*** | 233 | 25 | ***164*** |
| 3 <6 months | 411 | 52 | 159 | 244 | ***52*** | ***132*** | 282 | 27 | ***141*** |
| 6 <12 months | 678 | 41 | 126 | 466 | 34 | ***103*** | 588 | 30 | 112 |
| 1 <2 years | 1,002 | 23 | 71 | 611 | 20 | ***67*** | 728 | 13 | 51 |
| 2 <3 years | 994 | 23 | 60 | 571 | 19 | ***61*** | 751 | 15 | 58 |
| 3 <6 years | 4,112 | 22 | 61 | 1,091 | 18 | 51 | 1,418 | 11 | 42 |
| 6 <11 years | 1,553 | 16 | 43 | 1,601 | 14 | 43 | 2,292 | 10 | 34 |
| 11 <16 years | 975 | 12 | 34 | 2,396 | 10 | 32 | 2,551 | 6 | 26 |
| 16 <21 years | 743 | 12 | 33 | 2,332 | 9 | 32 | 2,191 | 6 | 28 |
| >21 years | 9,049 | 15 | 39 | 8,673 | 13 | 40 | 13,552 | 11 | 35 |
| All | 19,850 | 16 | 43 | 18,216 | 14 | 42 | 24,673 | 11 | 37 |
| Consumer Only (mL/day) | | | | | | | | | |
| Birth <1 month | 40 | ***470*** | ***858*** | 51 | ***409*** | ***852*** | 20 | 581 | ***938*** |
| 1 <3 months | 114 | 552 | ***1,053*** | 85 | ***531*** | ***1,019*** | 45 | 785 | ***1,223*** |
| 3 <6 months | 281 | 556 | ***1,171*** | 192 | ***520*** | ***929*** | 65 | 649 | ***1,125*** |
| 6 <12 months | 562 | 467 | 1,147 | 416 | 356 | ***948*** | 244 | 554 | ***1,104*** |
| 1 <2 years | 916 | 308 | 893 | 534 | 277 | ***781*** | 394 | 245 | 658 |
| 2 <3 years | 934 | 356 | 912 | 508 | 321 | ***911*** | 445 | 332 | 901 |
| 3 <6 years | 3,960 | 417 | 1,099 | 985 | 382 | 999 | 860 | 338 | 836 |
| 6 <11 years | 1,555 | 480 | 1,251 | 1,410 | 511 | 1,404 | 1,473 | 455 | 1,258 |
| 11 <16 years | 937 | 652 | 1,744 | 2,113 | 637 | 1,976 | 1,449 | 562 | 1,761 |
| 16 <21 years | 705 | 844 | 2,284 | 2,030 | 759 | 2,351 | 1,312 | 722 | 2,214 |
| >21 years | 8,505 | 1,183 | 2,848 | 7,616 | 1,227 | 3,092 | 8,912 | 1,276 | 3,075 |
| All | 18,509 | 1,000 | 2,601 | 15,940 | 1,033 | 2,881 | 15,219 | 1,096 | 2,972 |

**Table A-1. Comparison of Community Water Intake Estimates[a] 1994−1998 Continuing Survey of Food Intake by Individuals (CFSII), National Health and Nutrition Examination Survey (NHANES) 2003−2006, and NHANES 2005−2010 (Continued)**

| Age Range | CSFII 1994−1998[b] | | | NHANES 2003−2006[c] | | | NHANES 2005−2010[d] | | |
|---|---|---|---|---|---|---|---|---|---|
| | *N* | Mean | 95th | *N* | Mean | 95th | *N* | Mean | 95th |
| Consumer Only (mL/kg-day) | | | | | | | | | |
| Birth <1 month | 37 | ***137*** | ***238*** | 51 | ***90*** | ***172*** | 20 | 133 | ***224*** |
| 1 <3 months | 108 | 119 | ***285*** | 85 | ***93*** | ***186*** | 45 | 136 | ***267*** |
| 3 <6 months | 269 | 80 | ***173*** | 192 | ***73*** | ***140*** | 65 | 93 | ***158*** |
| 6 <12 months | 534 | 53 | 129 | 416 | 40 | ***104*** | 244 | 62 | ***133*** |
| 1 <2 years | 880 | 27 | 75 | 534 | 25 | ***71*** | 394 | 22 | 57 |
| 2 <3 years | 879 | 26 | 62 | 508 | 23 | ***62*** | 445 | 24 | 67 |
| 3 <6 years | 3,703 | 24 | 65 | 985 | 21 | 52 | 860 | 19 | 45 |
| 6 <11 years | 1,439 | 17 | 45 | 1,410 | 17 | 47 | 1,473 | 15 | 41 |
| 11 <16 years | 911 | 13 | 34 | 2,113 | 12 | 35 | 1,449 | 10 | 31 |
| 16 <21 years | 700 | 13 | 34 | 2,030 | 11 | 33 | 1,312 | 10 | 31 |
| >21 years | 8,355 | 16 | 39 | 7,616 | 16 | 36 | 8,912 | 17 | 41 |
| All | 17,815 | 17 | 44 | 15,940 | 16 | 44 | 15,219 | 17 | 44 |

[a] CSFII analysis assumes that some indirect water intake is from bottled water; NHANES analysis assumes that all indirect water intake is from community water.
[b] Used as the basis of recommended values for children <3 years of age in the *Exposure Factors Handbook: 2011 Edition* (U.S. EPA, 2011).
[c] Used as the basis of recommended values for ages ≥3 years in the *Exposure Factors Handbook: 2011 Edition* (U.S. EPA, 2011).
[d] Based on the new JIFSAN Food Intake Calculator.
CSFII = Continuing Survey of Food Intake by Individuals.
*N* = Number of observations.
NHANES = National Health and Nutrition Examination Survey.

***Bold italics text indicates less reliable estimates.***

**Table A-2. Comparison of Bottled Water Intake Estimates[a] 1994−1998 Continuing Survey of Food Intake by Individuals (CFSII), National Health and Nutrition Examination Survey (NHANES) 2003−2006, and NHANES 2005−2010**

| Age Range | CSFII 1994−1998 | | | NHANES 2003−2006 | | | NHANES 2005−2010 | | |
|---|---|---|---|---|---|---|---|---|---|
| | *N* | Mean | 95th | *N* | Mean | 95th | *N* | Mean | 95th |
| Per Capita (mL/day) | | | | | | | | | |
| Birth <1 month | 91 | 104 | ***556*** | 88 | ***6*** | ***28*** | 87 | 7 | ***44*** |
| 1 <3 months | 253 | 106 | ***771*** | 143 | ***21*** | ***122*** | 233 | 8 | ***44*** |
| 3 <6 months | 428 | 120 | 774 | 244 | ***12*** | *77* | 282 | 11 | ***89*** |
| 6 <12 months | 714 | 120 | 761 | 466 | 34 | ***187*** | 588 | 34 | 178 |
| 1 <2 years | 1,040 | 59 | 350 | 611 | 65 | ***342*** | 728 | 71 | 356 |
| 2 <3 years | 1,056 | 76 | 494 | 571 | 95 | ***575*** | 751 | 105 | 533 |
| 3 <6 years | 4,391 | 84 | 531 | 1,091 | 108 | 526 | 1,418 | 121 | 578 |
| 6 <11 years | 1,670 | 84 | 532 | 1,601 | 138 | 696 | 2,292 | 156 | 731 |
| 11 <16 years | 1,005 | 111 | 709 | 2,396 | 202 | 938 | 2,551 | 235 | 1,095 |
| 16 <21 years | 752 | 147 | 911 | 2,332 | 365 | 1,621 | 2,191 | 380 | 1,500 |
| >21 years | 9,207 | 189 | 1,183 | 8,673 | 375 | 1,718 | 13,552 | 335 | 1,542 |
| All | 20,607 | 163 | 1,059 | 18,216 | 321 | 1,502 | 24,673 | 326 | 1,570 |
| Per Capita (mL/kg-day) | | | | | | | | | |
| Birth <1 month | 88 | 33 | ***243*** | 88 | ***1*** | *7* | 87 | 2 | ***11*** |
| 1 <3 months | 245 | 22 | ***161*** | 143 | ***4*** | ***19*** | 233 | 1 | ***8*** |
| 3 <6 months | 411 | 16 | 117 | 244 | ***2*** | ***11*** | 282 | 2 | ***12*** |
| 6 <12 months | 678 | 13 | 87 | 466 | 4 | ***22*** | 588 | 4 | 21 |
| 1 <2 years | 1,002 | 5 | 28 | 611 | 6 | ***30*** | 728 | 6 | 32 |
| 2 <3 years | 994 | 5 | 35 | 571 | 7 | ***40*** | 751 | 8 | 39 |
| 3 <6 years | 4,112 | 5 | 30 | 1,091 | 6 | 31 | 1,418 | 7 | 32 |
| 6 <11 years | 1,553 | 3 | 18 | 1,601 | 4 | 24 | 2,292 | 5 | 23 |
| 11 <16 years | 975 | 2 | 14 | 2,396 | 4 | 17 | 2,551 | 4 | 19 |
| 16 <21 years | 743 | 3 | 15 | 2,332 | 5 | 24 | 2,191 | 6 | 24 |
| >21 years | 9,049 | 3 | 17 | 8,673 | 5 | 22 | 13,552 | 4 | 19 |
| All | 19,850 | 3 | 18 | 18,216 | 5 | 22 | 24,673 | 5 | 22 |
| Consumer Only (mL/day) | | | | | | | | | |
| Birth <1 month | 25 | - | - | 11 | ***55*** | ***190*** | 16 | 38 | ***155*** |
| 1 <3 months | 64 | 450 | ***1,045*** | 28 | ***135*** | ***347*** | 38 | 66 | ***192*** |
| 3 <6 months | 103 | 507 | ***1,436*** | 65 | ***69*** | ***202*** | 79 | 61 | ***133*** |
| 6 <12 months | 200 | 425 | ***1,103*** | 190 | ***111*** | ***359*** | 228 | 109 | ***281*** |
| 1 <2 years | 229 | 262 | ***709*** | 247 | ***193*** | ***474*** | 317 | 188 | ***578*** |
| 2 <3 years | 232 | 352 | ***977*** | 220 | ***276*** | ***1,000*** | 332 | 273 | ***711*** |
| 3 <6 years | 1,021 | 380 | 958 | 430 | 297 | ***825*** | 617 | 299 | 830 |
| 6 <11 years | 332 | 430 | ***1,081*** | 661 | 350 | ***898*** | 1,036 | 374 | 1,067 |
| 11 <16 years | 192 | 570 | ***1,447*** | 1,171 | 477 | 1,297 | 1,236 | 517 | 1,600 |
| 16 <21 years | 160 | 692 | 1,978 | 1,211 | 755 | 2,223 | 1,111 | 753 | 1,995 |
| >21 years | 1,893 | 831 | 1,773 | 3,836 | 840 | 2,363 | 6,299 | 771 | 2,160 |
| All | 4,451 | 736 | 1,567 | 8,070 | 738 | 2,133 | 736 | 736 | 2,133 |

**Table A-2. Comparison of Bottled Water Intake Estimates[a] 1994−1998 Continuing Survey of Food Intake by Individuals (CFSII), National Health and Nutrition Examination Survey (NHANES) 2003−2006, and NHANES 2005−2010 (Continued)**

| Age Range | CSFII 1994−1998 | | | NHANES 2003−2006 | | | NHANES 2005−2010 | | |
|---|---|---|---|---|---|---|---|---|---|
| | *N* | Mean | 95th | *N* | Mean | 95th | *N* | Mean | 95th |
| Consumer Only (mL/kg-day) | | | | | | | | | |
| Birth <1 month | 25 | - | - | 11 | ***12*** | ***38*** | 16 | 8 | ***31*** |
| 1 <3 months | 64 | ***92*** | ***220*** | 28 | ***24*** | ***63*** | 38 | 11 | ***31*** |
| 3 <6 months | 95 | 72 | ***184*** | 65 | ***10*** | ***27*** | 79 | 8 | ***19*** |
| 6 <12 months | 185 | 47 | ***120*** | 190 | ***12*** | ***36*** | 228 | 12 | ***32*** |
| 1 <2 years | 216 | 22 | ***66*** | 247 | ***17*** | ***44*** | 317 | 17 | ***48*** |
| 2 <3 years | 211 | 25 | ***81*** | 220 | ***20*** | ***68*** | 332 | 20 | ***52*** |
| 3 <6 years | 946 | 21 | 57 | 430 | 16 | ***47*** | 617 | 17 | 44 |
| 6 <11 years | 295 | 15 | ***42*** | 661 | 11 | ***31*** | 1,036 | 12 | 34 |
| 11 <16 years | 180 | 11 | ***27*** | 1,171 | 9 | 23 | 1,236 | 9 | 25 |
| 16 <21 years | 156 | 11 | 29 | 1,211 | 11 | 34 | 1,111 | 11 | 30 |
| >21 years | 1,861 | 12 | 30 | 3,836 | 11 | 29 | 6,299 | 10 | 28 |
| All | 4,234 | 13 | 36 | 8,070 | 11 | 31 | 11,309 | 11 | 30 |

[a] CSFII analysis includes direct and indirect bottled water intake. NHANES analyses include direct water intake only.
CSFII = Continuing Survey of Food Intake by Individuals.
*N* = Number of observations.
NHANES = National Health and Nutrition Examination Survey.

***Bold italics text indicates less reliable estimates.***

**Table A-3. Comparison of Other Sources of Water Intake Estimates[a] 1994−1998 Continuing Survey of Food Intake by Individuals (CFSII), National Health and Nutrition Examination Survey (NHANES) 2003−2006, and NHANES 2005−2010**

| Age Range | CSFII 1994−1998 | | | NHANES 2003−2006 | | | NHANES 2005−2010 | | |
|---|---|---|---|---|---|---|---|---|---|
| | *N* | Mean | 95th | *N* | Mean | 95th | *N* | Mean | 95th |
| Per Capita (mL/day) | | | | | | | | | |
| Birth <1 month | 91 | 13 | - | 88 | ***51*** | ***229*** | 87 | 273 | ***860*** |
| 1 <3 months | 253 | 35 | ***367*** | 143 | ***82*** | ***276*** | 233 | 351 | ***1,055*** |
| 3 <6 months | 428 | 45 | 365 | 244 | ***141*** | ***329*** | 282 | 355 | ***1,154*** |
| 6 <12 months | 714 | 45 | 406 | 466 | 124 | ***770*** | 588 | 274 | 1,023 |
| 1 <2 years | 1,040 | 22 | 118 | 611 | 82 | ***479*** | 728 | 77 | 356 |
| 2 <3 years | 1,056 | 39 | 344 | 571 | 74 | ***459*** | 751 | 93 | 524 |
| 3 <6 years | 4,391 | 43 | 343 | 1,091 | 62 | 433 | 1,418 | 84 | 481 |
| 6 <11 years | 1,670 | 61 | 468 | 1,601 | 108 | 659 | 2,292 | 105 | 614 |
| 11 <16 years | 1,005 | 102 | 786 | 2,396 | 163 | 1,030 | 2,551 | 198 | 1,078 |
| 16 <21 years | 752 | 72 | 493 | 2,332 | 184 | 1,193 | 2,191 | 217 | 1,221 |
| >21 years | 9,207 | 156 | 1,257 | 8,673 | 282 | 1,831 | 13,552 | 315 | 1,726 |
| All | 20,607 | 128 | 1,008 | 18,216 | 237 | 1,480 | 24,673 | 272 | 1,571 |
| Per Capita (mL/kg-day) | | | | | | | | | |
| Birth <1 month | 88 | 4 | - | 88 | ***11*** | ***45*** | 87 | 66 | ***206*** |
| 1 <3 months | 245 | 7 | ***52*** | 143 | ***14*** | ***49*** | 233 | 63 | ***195*** |
| 3 <6 months | 411 | 7 | 55 | 244 | ***20*** | ***60*** | 282 | 49 | ***157*** |
| 6 <12 months | 678 | 5 | 35 | 466 | 14 | ***74*** | 588 | 31 | 119 |
| 1 <2 years | 1,002 | 2 | 11 | 611 | 7 | ***43*** | 728 | 7 | 31 |
| 2 <3 years | 994 | 3 | 23 | 571 | 6 | ***34*** | 751 | 7 | 40 |
| 3 <6 years | 4,112 | 2 | 19 | 1,091 | 3 | 22 | 1,418 | 4 | 24 |
| 6 <11 years | 1,553 | 2 | 16 | 1,601 | 4 | 23 | 2,292 | 4 | 21 |
| 11 <16 years | 975 | 2 | 14 | 2,396 | 3 | 16 | 2,551 | 3 | 19 |
| 16 <21 years | 743 | 2 | 8 | 2,332 | 3 | 17 | 2,191 | 3 | 18 |
| >21 years | 9,049 | 2 | 17 | 8,673 | 4 | 23 | 13,552 | 4 | 23 |
| All | 19,850 | 2 | 16 | 18,216 | 4 | 23 | 24,673 | 5 | 25 |
| Consumer Only (mL/day) | | | | | | | | | |
| Birth <1 month | 3 | - | - | 41 | ***121*** | ***246*** | 47 | 611 | ***923*** |
| 1 <3 months | 19 | - | - | 67 | ***187*** | ***400*** | 134 | 704 | ***1,122*** |
| 3 <6 months | 38 | ***562*** | ***1,205*** | 160 | ***237*** | ***730*** | 175 | 665 | ***1,250*** |
| 6 <12 months | 73 | ***407*** | ***1,032*** | 287 | ***223*** | ***877*** | 328 | 564 | ***1,182*** |
| 1 <2 years | 98 | 262 | ***899*** | 312 | 155 | ***628*** | 310 | 209 | ***642*** |
| 2 <3 years | 129 | 354 | ***851*** | 256 | ***163*** | ***798*** | 282 | 268 | ***887*** |
| 3 <6 years | 533 | 396 | 1,019 | 449 | 155 | ***631*** | 525 | 231 | 721 |
| 6 <11 years | 219 | 448 | ***1,090*** | 609 | 270 | ***1,065*** | 755 | 331 | 948 |
| 11 <16 years | 151 | 687 | ***1,839*** | 1,116 | 367 | 1,467 | 994 | 513 | 1,526 |
| 16 <21 years | 86 | 613 | 1,923 | 1,039 | 437 | 2,145 | 760 | 632 | 2,297 |
| >21 years | 1,386 | 1,137 | 2,739 | 3,555 | 672 | 2,774 | 4,412 | 1,002 | 2,798 |
| All | 2,735 | 963 | 2,468 | 7,891 | 559 | 2,381 | 8,722 | 833 | 2,682 |

**Table A-3. Comparison of Other Sources of Water Intake Estimates[a] 1994−1998 Continuing Survey of Food Intake by Individuals (CFSII), National Health and Nutrition Examination Survey (NHANES) 2003−2006, and NHANES 2005−2010 (Continued)**

| Age Range | CSFII 1994−1998 | | | NHANES 2003−2006 | | | NHANES 2005−2010 | | |
|---|---|---|---|---|---|---|---|---|---|
| | *N* | Mean | 95th | *N* | Mean | 95th | *N* | Mean | 95th |
| Consumer Only (mL/kg-day) | | | | | | | | | |
| Birth <1 month | 3 | - | - | 41 | ***26*** | ***51*** | 47 | 148 | ***297*** |
| 1 <3 months | 19 | - | - | 67 | ***31*** | ***69*** | 134 | 126 | ***218*** |
| 3 <6 months | 38 | ***80*** | ***200*** | 160 | ***33*** | ***113*** | 175 | 92 | ***176*** |
| 6 <12 months | 68 | ***44*** | ***106*** | 287 | ***25*** | ***98*** | 328 | 64 | ***141*** |
| 1 <2 years | 95 | 23 | ***84*** | 312 | 14 | ***54*** | 310 | 19 | ***58*** |
| 2 <3 years | 124 | 26 | ***66*** | 256 | ***12*** | ***62*** | 282 | 20 | ***64*** |
| 3 <6 years | 505 | 22 | 56 | 449 | 8 | ***28*** | 525 | 12 | 34 |
| 6 <11 years | 208 | 16 | ***39*** | 609 | 9 | ***33*** | 755 | 11 | 36 |
| 11 <16 years | 148 | 13 | ***36*** | 1,116 | 6 | 23 | 994 | 9 | 27 |
| 16 <21 years | 85 | 9 | 28 | 1,039 | 6 | 28 | 760 | 9 | 30 |
| >21 years | 1,365 | 15 | 39 | 3,555 | 9 | 35 | 4,412 | 13 | 36 |
| All | 2,657 | 16 | 41 | 7,891 | 9 | 35 | 8,722 | 14 | 43 |

[a] Includes both direct and indirect water intake.
CSFII = Continuing Survey of Food Intake by Individuals.
*N* = Number of observations.
NHANES = National Health and Nutrition Examination Survey.

***Bold italics text indicates less reliable estimates.***

**Table A-4. Comparison of All Sources of Water Intake Estimates[a] 1994−1998 Continuing Survey of Food Intake by Individuals (CFSII), National Health and Nutrition Examination Survey (NHANES) 2003−2006, and NHANES 2005−2010**

| | CSFII 1994−1998 | | | NHANES 2003−2006 | | | NHANES 2005−2010 | | |
|---|---|---|---|---|---|---|---|---|---|
| Age Range | *N* | Mean | 95th | *N* | Mean | 95th | *N* | Mean | 95th |
| Per Capita (mL/day) | | | | | | | | | |
| Birth <1 month | 91 | 301 | ***877*** | 88 | ***295*** | ***954*** | 87 | 464 | ***945*** |
| 1 <3 months | 253 | 368 | ***1,020*** | 143 | ***385*** | ***1,084*** | 233 | 505 | ***1,124*** |
| 3 <6 months | 428 | 528 | 1,303 | 244 | ***527*** | ***1,192*** | 282 | 552 | ***1,207*** |
| 6 <12 months | 714 | 530 | 1,278 | 466 | 461 | ***1,126*** | 588 | 576 | 1,168 |
| 1 <2 years | 1,040 | 358 | 961 | 611 | 370 | ***912*** | 728 | 293 | 768 |
| 2 <3 years | 1,056 | 437 | 999 | 571 | 435 | ***1,086*** | 751 | 403 | 1,001 |
| 3 <6 years | 4,391 | 514 | 1,200 | 1,091 | 498 | 1,181 | 1,418 | 413 | 980 |
| 6 <11 years | 1,670 | 600 | 1,409 | 1,601 | 660 | 1,567 | 2,292 | 555 | 1,389 |
| 11 <16 years | 1,005 | 834 | 1,960 | 2,396 | 885 | 2,595 | 2,551 | 748 | 2,242 |
| 16 <21 years | 752 | 1,020 | 2,665 | 2,332 | 1,177 | 2,999 | 2,191 | 1,033 | 2,741 |
| >21 years | 9,207 | 1,466 | 3,195 | 8,673 | 1,700 | 3,727 | 13,552 | 1,500 | 3,350 |
| All | 20,607 | 1,233 | 2,908 | 18,216 | 1,426 | 3,412 | 24,673 | 1,309 | 3,292 |
| Per Capita (mL/kg-day) | | | | | | | | | |
| Birth <1 month | 88 | 89 | ***269*** | 88 | ***65*** | ***195*** | 87 | 110 | ***253*** |
| 1 <3 months | 245 | 77 | ***246*** | 143 | ***67*** | ***194*** | 233 | 89 | ***204*** |
| 3 <6 months | 411 | 75 | 186 | 244 | ***74*** | ***179*** | 282 | 77 | ***165*** |
| 6 <12 months | 678 | 59 | 148 | 466 | 52 | ***137*** | 588 | 65 | 138 |
| 1 <2 years | 1,002 | 31 | 85 | 611 | 33 | ***80*** | 728 | 26 | 69 |
| 2 <3 years | 994 | 31 | 73 | 571 | 32 | ***78*** | 751 | 29 | 71 |
| 3 <6 years | 4,112 | 29 | 69 | 1,091 | 27 | 63 | 1,418 | 23 | 54 |
| 6 <11 years | 1,553 | 21 | 50 | 1,601 | 22 | 52 | 2,292 | 18 | 47 |
| 11 <16 years | 975 | 16 | 39 | 2,396 | 16 | 44 | 2,551 | 13 | 38 |
| 16 <21 years | 743 | 16 | 39 | 2,332 | 17 | 44 | 2,191 | 15 | 41 |
| >21 years | 9,049 | 20 | 44 | 8,673 | 22 | 50 | 13,552 | 19 | 44 |
| All | 19,850 | 21 | 50 | 18,216 | 22 | 53 | 24,673 | 20 | 49 |
| Consumer Only mL/day | | | | | | | | | |
| Birth <1 month | 58 | ***511*** | ***986*** | 54 | ***481*** | ***996*** | 68 | 597 | ***953*** |
| 1 <3 months | 178 | 555 | ***1,072*** | 92 | ***665*** | ***1,099*** | 182 | 725 | ***1,154*** |
| 3 <6 months | 363 | 629 | ***1,330*** | 209 | ***660*** | ***1,215*** | 243 | 666 | ***1,251*** |
| 6 <12 months | 667 | 567 | 1,303 | 453 | 477 | ***1,128*** | 577 | 590 | ***1,182*** |
| 1 <2 years | 1,017 | 366 | 978 | 596 | 378 | ***914*** | 714 | 300 | 768 |
| 2 <3 years | 1,051 | 439 | 1,001 | 560 | 441 | ***1,087*** | 741 | 408 | 1,001 |
| 3 <6 years | 4,350 | 518 | 1,206 | 1,077 | 506 | 1,182 | 1,405 | 416 | 993 |
| 6 <11 years | 1,659 | 603 | 1,409 | 1,580 | 666 | 1,585 | 2,263 | 565 | 1,389 |
| 11 <16 years | 1,000 | 837 | 1,961 | 2,362 | 898 | 2,600 | 2,504 | 767 | 2,248 |
| 16 <21 years | 740 | 1,039 | 2,674 | 2,269 | 1,208 | 3,015 | 2,129 | 1,068 | 2,808 |
| >21 years | 9,178 | 1,472 | 3,195 | 8,608 | 1,712 | 3,733 | 13,473 | 1,508 | 3,354 |
| All | 20,261 | 1,242 | 2,923 | 17,860 | 1,444 | 3,422 | 24,299 | 1,325 | 3,306 |

**Table A-4. Comparison of All Sources of Water Intake Estimates[a] 1994−1998 Continuing Survey of Food Intake by Individuals (CFSII), National Health and Nutrition Examination Survey (NHANES) 2003−2006, and NHANES 2005−2010 (Continued)**

| Age Range | CSFII 1994−1998 | | | NHANES 2003−2006 | | | NHANES 2005−2010 | | |
|---|---|---|---|---|---|---|---|---|---|
| | *N* | Mean | 95th | *N* | Mean | 95th | *N* | Mean | 95th |
| Consumer Only (mL/kg-day) | | | | | | | | | |
| Birth <1 month | 55 | ***153*** | ***273*** | 54 | ***105*** | ***211*** | 68 | 141 | ***263*** |
| 1 <3 months | 172 | 116 | ***291*** | 92 | ***115*** | ***201*** | 182 | 128 | ***218*** |
| 3 <6 months | 346 | 90 | ***195*** | 209 | ***92*** | ***186*** | 243 | 93 | ***174*** |
| 6 <12 months | 631 | 63 | 152 | 453 | 54 | ***137*** | 577 | 66 | ***139*** |
| 1 <2 years | 980 | 31 | 86 | 596 | 34 | ***82*** | 714 | 27 | 69 |
| 2 <3 years | 989 | 31 | 73 | 560 | 32 | ***78*** | 741 | 29 | 72 |
| 3 <6 years | 4,072 | 29 | 70 | 1,077 | 27 | 63 | 1,405 | 23 | 54 |
| 6 <11 years | 1,542 | 21 | 50 | 1,580 | 22 | 52 | 2,263 | 19 | 48 |
| 11 <16 years | 970 | 16 | 39 | 2,362 | 16 | 44 | 2,504 | 14 | 38 |
| 16 <21 years | 732 | 16 | 39 | 2,269 | 18 | 45 | 2,129 | 15 | 41 |
| >21 years | 9,020 | 20 | 44 | 8,608 | 22 | 50 | 13,473 | 19 | 44 |
| All | 19,509 | 21 | 50 | 17,860 | 22 | 53 | 24,299 | 20 | 50 |

[a] CSFII analysis includes direct and indirect bottled water. NHANES analysis assumes that all indirect water intake is from community water.

CSFII = Continuing Survey of Food Intake by Individuals.

*N* = Number of observations.

NHANES = National Health and Nutrition Examination Survey.

***Bold italics text indicates less reliable estimates.***

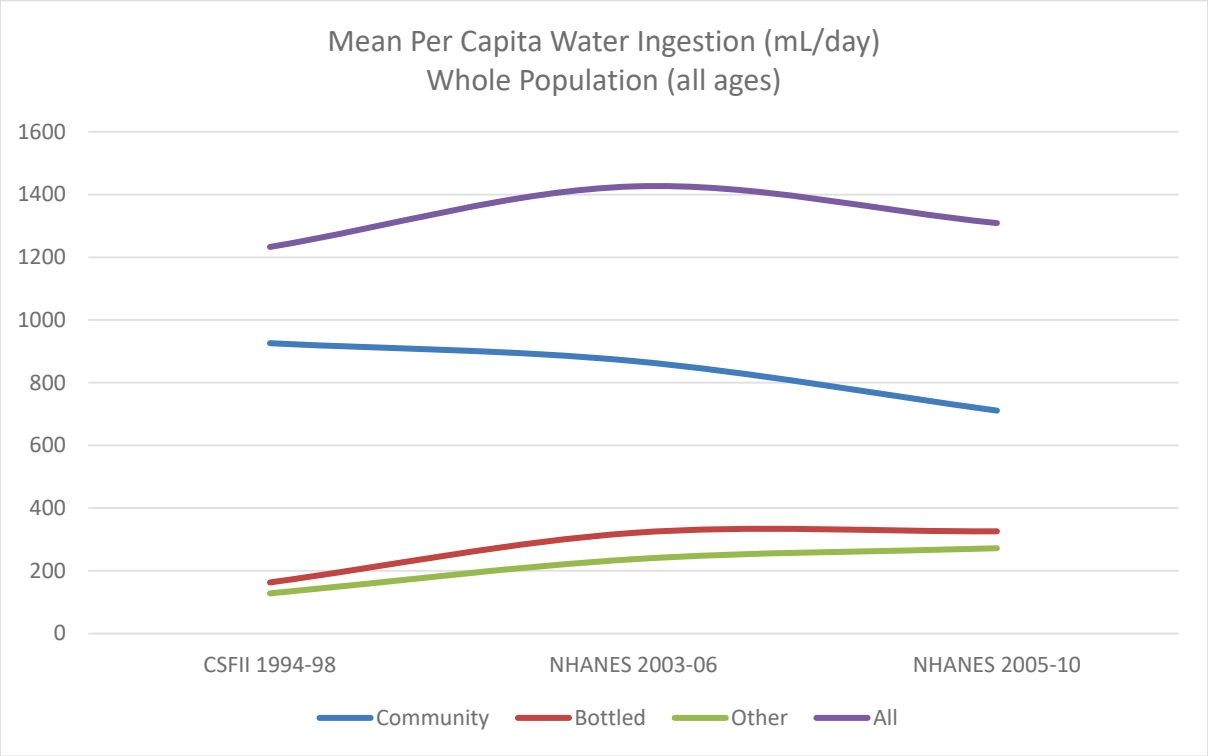


**Figure A-1. Comparison of mean per capita water ingestion (mL/day), all ages: Continuing Survey of Food Intake by Individuals (CSFII) 1994−1996, 1998; National Health and Nutrition Examination Survey (NHANES) 2003−2006, and NHANES 2005−2010.**

**APPENDIX B**

| Table B-1. Terms Used in Literature Searches |
|---|
| Water ingestion |
| Water intake |
| Water consumption |
| Direct water ingestion/intake/consumption |
| Indirect water ingestion/intake/consumption |
| Bottled water ingestion/intake/consumption |
| Well water ingestion/intake/consumption |
| Spring water ingestion/intake/consumption |
| Tap water ingestion/intake/consumption |
| Incidental water ingestion/intake/consumption |
| Community water ingestion/intake/consumption |
| Municipal water ingestion/intake/consumption |
| Commercial water ingestion/intake/consumption |
| Drinking water source |
| Intrinsic water ingestion/intake/consumption |
| Surface water ingestion/intake/consumption |
| Consumer only water ingestion/intake/consumption |
| Per capita water ingestion/intake/consumption |
| Liquid ingestion/intake/consumption |
| Chlorinated/nonchlorinated ingestion/intake/consumption |
| Water…and activity level |
| Water…and bathers |
| Water…and climate |
| Water…and health status |
| Water…and pregnancy |
| Water…and lactation |
| Water…and diabetes |
| Water…and smoking |
| Water…and swimming/diving |
| Water…and recreational activities |
| Fluid intake |
| Beverage intake |
| Ershow AG |
| Marshall T |