3. Trace Elements

Iron-Status Indicators

- Ferritin
- Soluble transferrin receptor
- Body iron

Iodine
Iron-Status Indicators

Background Information

Sources and Physiological Functions. Iron functions as a component of proteins and enzymes. Almost two-thirds of the iron in the body (approximately 2.5 grams of iron) is found in hemoglobin, the protein in red blood cells that carries oxygen to tissues, and about 15% is in the myoglobin of muscle tissue. The average American diet provides 10–15 milligrams (mg) of iron daily in the form of heme and nonheme iron. Heme iron is found in animal foods that originally contained hemoglobin and myoglobin, such as red meat, fish, and poultry. Nonheme iron is found in plant foods, such as lentils and beans, and also is provided in iron-enriched and iron-fortified foods. Although heme iron is absorbed better than nonheme iron, most dietary iron is nonheme iron (Miret 2003). Each day the body absorbs approximately 1–2 mg of iron to compensate for the 1 to 2 mg of iron that the (nonmenstruating) body loses (Institute of Medicine 2001). The current Dietary Guidelines for Americans list iron as a nutrient of concern for specific population groups. The guidelines recommend that pregnant women take an iron supplement, as recommended by an obstetrician or other health care provider (U.S. Department of Agriculture 2010).

Health Effects. Transporting iron from one organ to another is accomplished by the reversible binding of iron to the transport protein, transferrin, which will then form a complex with a highly specific transferrin receptor (TfR) located on the plasma membrane surfaces of cells. Intracellular iron availability is regulated through the increased expression of cellular TfR concentration by iron-deficient cells. Ferritin is the major iron-storage compound: its production increases in cells as iron supplies increase. The major function of ferritin is to provide a store of iron which may be used for haem synthesis when required. Although all cells are capable of storing iron, the liver, spleen, and bone marrow cells are primary iron-storage sites in people (Institute of Medicine 2001).

Iron deficiency and iron overload are the two major disorders of iron metabolism. Iron-deficiency anemia is the most severe form of iron deficiency. It is linked to many adverse consequences of iron deficiency, such as reduced physical capacity (Haas 2001) and poor pregnancy outcomes (Schorr 1994). Iron deficiency with and without anemia, however, has been linked to negative effects on cognitive development among infants and adolescents (Beard 1999; Grantham-McGregor 2001). Iron overload is the accumulation of excess iron in body tissues, and it usually occurs as a result of a genetic predisposition to absorb iron in excess of normal. However, it can also be caused by excessive ingestion of iron supplements or multiple blood transfusions (Pietrangelo 2004). In advanced stages of iron overload disease (hemochromatosis), the iron accumulates in the parenchymal cells of several organs, but particularly the liver, followed by the heart and pancreas; this condition can lead to organ dysfunction and even death (Pietrangelo 2004).

Intake Recommendations. The Recommended Dietary Allowance (RDA) for all age groups of men and postmenopausal women is 8 mg per day; the RDA for premenopausal women is 18 mg per day. The Tolerable Upper Uptake Level for adults is 45 mg per day of iron, a level based on gastrointestinal distress as an adverse effect (Institute of Medicine 2001).

Biochemical Indicators and Methods. Ferritin is present in the blood in very low concentrations. Serum ferritin is in equilibrium with tissue stores, and its concentration declines early in the development of iron deficiency. Low serum ferritin concentration thus is a sensitive indicator of iron deficiency, but it does not necessarily reflect the severity of the depletion as it progresses (World Health Organization 2011). Ferritin is also an acute-phase protein; acute and chronic diseases can result in increased ferritin concentration, potentially masking an iron-deficiency diagnosis. A review
article on serum ferritin written as part of a 2004 WHO/CDC Technical Consultation on the Assessment of Iron Status at the Population Level provides comprehensive information on this topic (Worwood 2007). The generally accepted cutoff value for serum ferritin below which iron stores are considered to be depleted is 15 nanogram per milliliter (ng/mL) for people aged 5 years and older and 12 ng/mL for people younger than 5 years of age (World Health Organization 2001; World Health Organization 2011). Serum ferritin concentrations above 200 ng/mL for adult males and 150 ng/mL for adult females are considered to represent severe risk of iron overload (World Health Organization 2001; World Health Organization 2011).

Soluble TfR (sTfR) is the truncated form of the membrane-bound TfR that is cleaved and released into the serum. The amount of sTfR is proportional to the number of membrane-bound TfR. sTfR circulates bound to transferrin, and its concentration is not strongly affected by concurrent inflammation or infection (Beard 2007). Serum sTfR concentration increases when the iron functional pool is depleted and during activated erythropoiesis (Kuiper-Kramer 1998). It continues to do so as the severity of iron-deficient erythropoiesis increases, reflecting the increasing number of receptors on the erythroid cells of the bone marrow. The measurement of sTfR is therefore a powerful tool for the diagnosis of iron deficiency or for monitoring erythropoiesis.

Serum ferritin is the most sensitive index of iron status when there are residual iron stores, whereas serum sTfR is more sensitive when there is functional iron deficiency (Skikne 1990). There is a close, linear relationship between the logarithm of the sTfR to serum ferritin ratio and stored iron (body iron) expressed as mg per kg body weight (Skikne 1990). Recently Cook et al. demonstrated that in healthy persons body iron may be estimated from the ratio of sTfR to serum ferritin (reported in microgram [µg]/mL for both assays) (2003). Body iron is in a positive balance (≥ 0 mg/kg) when there is residual storage iron or in a negative balance (< 0 mg/kg) when there is functional iron deficiency. The latter represents a deficit in iron required to maintain a normal hemoglobin concentration. The body iron methodology allows the full range of iron status of populations to be evaluated. Other iron status indicators, such as serum iron, total iron binding capacity, transferrin saturation, and erythrocyte protoporphyrin, were described in the previous report of this series. They are not included in the current report.

Clinical laboratories typically use conventional units for iron-status indicators: ferritin is calculated in nanograms per milliliter (ng/mL) and sTfR in milligrams per liter (mg/L). Conversion factors to international system (SI) units are as follows: 1 ng/mL = 2.247 picomole (pmol)/L for ferritin and 1 mg/L = 0.085 nanomole (nmol)/L for sTfR.

The most widely used methods to measure both serum ferritin and sTfR are immunoassay-based (ELISA, immuno-turbidimetry, immunonephelometry) (Worwood 2002a; Worwood 2002b). A WHO-supported international reference material from the United Kingdom National Institute for Biological Standards and Control (NIBSC) has been available for ferritin for several years (94/572); it has helped to improve the comparability of commercial kit assays. On the other hand, commercial kit assays for sTfR produce different results, making the use of assay-specific reference intervals and...
cutoff values necessary (Beard 2007). Recently, the WHO supported the development of a reference reagent for sTfR by the NIBSC, and material 07-202 was released in 2010. It is hoped that this material will be used by manufacturers to standardize sTfR assays and promote the establishment of cutoff values used to assess the iron status of populations (Thorpe 2010).

**Data in NHANES.** Monitoring the iron status of the U.S. population has been an important component since the inception of NHANES in 1971, and each NHANES has included a battery of hematologic and biochemical indicators of iron status (Looker 1995). Since NHANES II (1976–1980), models that employ multiple biochemical iron-status indicators have been used to define iron deficiency in the population (Pilch 1984). The ferritin model (also known as the three-indicator model), using serum ferritin, transferrin saturation, and erythrocyte protoporphyrin, was developed in 1980 and applied to NHANES III (1988–1994) as well as to the first few years of the continuous NHANES survey beginning in 1999. Prevalence estimates of iron deficiency using the three-indicator model were similar in NHANES III (Looker 1997) and in NHANES 1999–2000 (Looker 2002).

Starting in 2003, NHANES limited the population of interest to children (1–5 years) and women of childbearing age (12–49 years). Furthermore, the measurement of serum sTfR was introduced, which allows the evaluation of iron status by the body iron model developed by Cook et al. (2003). Using data for children and non-pregnant women from NHANES 2003–2006, Cogswell et al. compared the new body iron model to the previously used ferritin model (2009). The agreement between the two models was fair to good. Among non-pregnant women, the body iron model produced lower estimates of iron deficiency prevalence and better predicted anemia. The body iron model appeared to be less affected by inflammation than the ferritin model.

Two national health objectives that relate to iron deficiency reduction are part of the objectives for Healthy People 2020: Objective NWS HP2020-21 (reduce iron deficiency among young children and females of childbearing age) and Objective NWS HP2020-22 (reduce iron deficiency among pregnant females) (http://www.healthypeople.gov/HP2020/). To provide data for these objectives, NHANES continues with periodic monitoring of iron status in the population groups of interest.

Ferritin and sTfR data presented in this report were generated by use of commercial assay kits. Serum ferritin was first measured by use of the BioRad QuantImune immunoradiometric assay (1999–2003), then by use of the Roche TinaQuant immunoturbidimetric assay on the Hitachi 912 clinical analyzer (2004–2006). The public release data file for 2003–2004 has already been adjusted to the new assay. We used adjustment equations provided in the analytical note for data from 1999–2002 to make the data comparable to the new assay (http://www.cdc.gov/nchs/nhanes/nhanes2003-2004/L06TFR_C.htm#Analytic_Notes). Serum sTfR was measured with the Roche immunoturbidimetric assay on the Hitachi 912 clinical analyzer (2003–2006). We calculated body iron by using the following formula (Cook 2003): body iron (mg/kg) = -[log10 (sTfR * 1000 / ferritin) – 2.8229] / 0.1207. The sTfR concentration in this formula represents an adjusted concentration to make the Roche sTfR concentrations equivalent to the Flowers assay (1989) used in the development of the body iron model: Flowers sTfR = 1.5 * Roche sTfR + 0.35 mg/L (Pfeiffer 2007).

To estimate the prevalence of low serum ferritin concentrations, we used the generally accepted cutoff values mentioned above: 12 ng/mL for children 1-5 years of age and 15 ng/mL for women of childbearing age and males 6 years and older. To estimate the prevalence of high serum ferritin concentrations, we also used the cutoff values mentioned above: 150 ng/mL for women 12-49 years of age and 200 ng/mL for men 12 years and older. Due to the lack of generally accepted cutoff values for serum sTfR, we used the manufacturer provided assay-specific cutoff value of 4.4 mg/L to estimate the prevalence of high sTfR concentrations in women of childbearing age. The prevalence of low body iron (< 0 mg/kg) is indicative of the extent of iron deficiency in the population.
For more information about iron, see the Institute of Medicine’s Dietary Reference Intake reports (Institute of Medicine 2001) and fact sheets from the National Institutes of Health, Office of Dietary Supplements (http://ods.od.nih.gov/Health_Information/Information_About_Individual_Dietary_Supplements.aspx).

**Highlights**

Serum concentrations of ferritin and sTfR in the U.S. population showed the following demographic patterns and characteristics:

- Children had the lowest ferritin concentrations and highest sTfR concentrations compared to other age groups.
- Regardless of the indicator selected (serum ferritin, sTfR, or body iron), the likelihood of being iron deficient varied by race/ethnic group.
- While children and women of childbearing age were at risk for iron deficiency, men were at risk for iron excess.

New data from NHANES 2003–2006 allow for the first time assessment of the iron status of children and women of childbearing age by way of a new indicator, body iron. Using the ferritin model in NHANES 1999–2000, Looker and colleagues (2002) showed that the prevalence of iron deficiency was higher in Mexican-American (22%) and non-Hispanic black (19%) women aged 12–49 years than for non-Hispanic white women (10%). We saw the same pattern in NHANES 2003–2006 for women of childbearing age by using low body iron ( < 0 mg/kg) as an indicator of iron deficiency (Figure H.3.a). We saw a higher prevalence of low body iron in Mexican-American children (1–5 years) than in non-Hispanic black and non-Hispanic white children (Figure H.3.a).

The prevalence estimates of iron deficiency may vary depending on which indicator or set of indicators is used. Furthermore, the prevalence may be overestimated by using only a single indicator. In women of childbearing age, we found the lowest prevalence by using body iron (10%), intermediate prevalence by using low ferritin concentrations (13%), and the highest prevalence by using high sTfR concentrations (19%) (Figure H.3.b).

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**Figure H.3.a.** Age-adjusted prevalence estimates of low body iron stores (< 0 mg/kg) in U.S. children and women by race/ethnicity, National Health and Nutrition Examination Survey, 2003–2006.

Error bars represent 95% confidence intervals. Bars not sharing a common letter differ within children and women (p < 0.05). Age adjustment was done using direct standardization.

**Figure H.3.b.** Prevalence estimates of low serum ferritin, high serum soluble transferrin receptor, and low serum body iron in U.S. women 12–49 years of age, National Health and Nutrition Examination Survey, 2003–2006.

Error bars represent 95% confidence intervals.
Women were at risk for iron deficiency, while men were at risk for iron excess, as can be seen from the large differences in the prevalence of low and high serum ferritin concentrations between men and women (Figure H.3.c). During NHANES 1999–2002, the prevalence of low serum ferritin concentrations (< 15 ng/mL) was much lower in 12–49 year-old men (1%) than in 12–49 year-old women (13%). Conversely, the prevalence of high serum ferritin concentrations (> 200 ng/mL for men and > 150 ng/mL for women) was much higher in men (29%) than in women (6%). NHANES 2003–2006 showed similar prevalence estimates for women as were seen in 1999–2002. No data are available for men in 2003–2006.

Figure H.3.c. Age-adjusted prevalence estimates of low (< 15 ng/mL) and high serum ferritin (> 200 ng/mL for men and > 150 ng/mL for women) in U.S. men and women aged 12–49 years, National Health and Nutrition Examination Survey, 1999–2006. Error bars represent 95% confidence intervals. Within each ferritin status category, bars not sharing a common letter differ (p < 0.05). Age adjustment was done using direct standardization.

Serum ferritin has been assessed as part of NHANES for many years, allowing for the evaluation of temporal changes in concentrations. Overall, there were only minor changes in serum ferritin concentrations in women of childbearing age over a period of almost two decades (Figure H.3.d). Age-adjusted mean serum ferritin concentrations in women of childbearing age were slightly lower (< 10%) in 1999–2002 and 2003–2006 than in 1988–1994. We observed the same pattern for non-Hispanic white women, while serum ferritin concentrations decreased further during 2003–2006 for non-Hispanic black women. Mexican-American women had lower serum ferritin concentrations in 1999–2002 than in 1988–1994, but concentrations in 2003–2006 did not differ from concentrations in the two previous time periods.

Error bars represent 95% confidence intervals. Within a demographic group, bars not sharing a common letter differ (p < 0.05). Age adjustment was done using direct standardization.

Detailed Observations

The selected observations mentioned below are derived from the tables and figures presented next. Statements about categorical differences between demographic groups noted below are based on non-overlapping confidence limits from univariate analysis without adjusting for demographic variables (e.g., age, sex, race/ethnicity) or other determinants of these blood concentrations (e.g., dietary intake, supplement usage, smoking, BMI). A multivariate analysis may alter the size and statistical significance of these categorical differences. Furthermore, additional significant differences of smaller magnitude may be present despite their lack of mention here (e.g., if confidence limits slightly overlap or if differences are not statistically significant before covariate adjustment has occurred). For a selection of citations of descriptive NHANES papers related to these biochemical indicators of diet and nutrition, see Appendix G.

Geometric/arithmetic mean concentrations (NHANES 2003–2006):

- The distribution of body iron was reasonably symmetric and for that reason we present arithmetic means.
- Serum ferritin concentrations increased with age (Table 3.1.a.1 and Figure 3.1.a).
- sTfR concentrations were highest in children than for both adolescent and adult women (Table 3.2.a.1 and Figure 3.2.a).
- Body iron was lowest in children, intermediate in adolescent women, and highest in adult women (Table 3.3.a.1 and Figure 3.3.a).
- Non-Hispanic whites had higher serum ferritin concentrations than Mexican Americans, and non-Hispanic blacks had intermediate concentrations (Table 3.1.a.1).
- Non-Hispanic whites had lower sTfR concentrations than Mexican Americans, who had lower concentrations still than non-Hispanic blacks (Table 3.2.a.1).
- Non-Hispanic whites had higher body iron than the other two race/ethnic groups (Table 3.3.a.1).
Changes in geometric/arithmetic mean concentrations across survey cycles:

- All three iron status indicators remained stable across the survey cycles measured: serum ferritin geometric mean concentrations (Table 3.1.b) between 1999 and 2006; sTfR geometric mean concentrations (Table 3.2.b) and body iron arithmetic means (Table 3.3.b) between 2003 and 2006.

Prevalence estimates of low or high biochemical indicator concentrations:

- In 2003–2006, approximately 9% of children (1–5 years) (Table 3.1.c.1) had serum ferritin concentrations < 12 ng/mL and 14% of women (12–49 years) had serum ferritin concentrations < 15 ng/mL (Table 3.1.c.2). Approximately 5% of women (12–49 years) (Table 3.1.c.3) had high serum ferritin concentrations (> 150 ng/mL), indicating severe risk of iron overload.

- The prevalence of low serum ferritin concentrations did not change between 1999 and 2006 in children (Table 3.1.d.1) and women of childbearing age (Table 3.1.d.2), nor between 1999 and 2002 in males 6 years and older (Table 3.1.d.3). The prevalence of high serum ferritin concentrations also remained constant between 1999 and 2006 in women of childbearing age (Table 3.1.d.4) and between 1999–2002 in men 12 years and older (Table 3.1.d.5).

- In 2003–2006, approximately 19% of women (12–49 years) had serum sTfR concentrations > 4.4 mg/L (Table 3.2.c), and the prevalence was the same in both survey cycles (Table 3.2.d).

- Less than 10% of children (8% of boys and 5% of girls 1–5 years) and 10% of women (12–49 years) had negative body iron balance, indicative of iron deficiency (Tables 3.3.c.1 and 3.3.c.2), and the prevalence was the same in both survey cycles (Tables 3.3.d.1 and 3.3.d.2).
Table 3.1.a.1. Serum ferritin: Concentrations

Geometric mean and selected percentiles of serum concentrations (in ng/mL) for children aged 1–5 years and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th></th>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.5th</td>
<td>5th</td>
<td>50th</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>35.7 (34.4 – 37.1)</td>
<td>4.65 (4.52 – 4.78)</td>
<td>6.99 (6.15 – 7.71)</td>
</tr>
<tr>
<td>(Children 1–5 years women 12–49 years),</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Age group</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1–5 years (Children)</td>
<td>26.2 (25.2 – 27.3)</td>
<td>6.68 (5.19 – 7.72)</td>
<td>9.14 (7.87 – 9.82)</td>
</tr>
<tr>
<td>12–19 years (Women)</td>
<td>29.3 (27.7 – 30.9)</td>
<td>4.64 (4.31 – 4.98)</td>
<td>6.83 (5.19 – 7.77)</td>
</tr>
<tr>
<td>20–39 years (Women)</td>
<td>38.1 (36.1 – 40.2)</td>
<td>4.67 (4.45 – 4.88)</td>
<td>7.19 (5.66 – 8.21)</td>
</tr>
<tr>
<td>40–49 years (Women)</td>
<td>43.2 (39.0 – 47.7)</td>
<td>4.38 (4.06 – 4.69)</td>
<td>5.81 (4.73 – 7.10)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males (1–5 years)</td>
<td>26.2 (24.9 – 27.7)</td>
<td>6.90 (4.61 – 7.90)</td>
<td>8.90 (8.01 – 9.68)</td>
</tr>
<tr>
<td>Females (1–5, 12–49 years)</td>
<td>36.6 (35.2 – 38.1)</td>
<td>4.62 (4.48 – 4.75)</td>
<td>6.80 (5.96 – 7.56)</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexican Americans</td>
<td>30.2 (27.5 – 33.1)</td>
<td>4.18 (3.78 – 4.43)</td>
<td>4.87 (4.62 – 5.46)</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td>33.5 (31.4 – 35.7)</td>
<td>4.13 (3.31 – 4.70)</td>
<td>5.49 (4.69 – 6.46)</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td>37.5 (35.5 – 39.6)</td>
<td>4.89 (4.66 – 5.44)</td>
<td>8.07 (6.52 – 8.85)</td>
</tr>
</tbody>
</table>
Figure 3.1. a. Serum ferritin: Concentrations by age group
Geometric mean (95% confidence interval), National Health and Nutrition Examination Survey, 2003–2006
Table 3.1.a.2. Serum ferritin: Total population
Geometric mean and selected percentiles of serum concentrations (in ng/mL) for children aged 1–5 years and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Sample size</th>
<th>5th</th>
<th>50th</th>
<th>95th</th>
</tr>
</thead>
<tbody>
<tr>
<td>143</td>
<td>26.7</td>
<td>(25.5–27.9)</td>
<td>65.6</td>
</tr>
</tbody>
</table>

Table 3.1.a.3. Serum ferritin: Mexican Americans
Geometric mean and selected percentiles of serum concentrations (in ng/mL) for Mexican-American children aged 1–5 years and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Sample size</th>
<th>5th</th>
<th>50th</th>
<th>95th</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,255</td>
<td>36.6</td>
<td>(35.2–38.1)</td>
<td>6.80</td>
</tr>
</tbody>
</table>

† Estimate is subject to greater uncertainty due to small cell size.
### Table 3.1.a.4. Serum ferritin: Non-Hispanic blacks

Geometric mean and selected percentiles of serum concentrations (in ng/mL) for non-Hispanic black children aged 1–5 years and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th></th>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>5th (95% conf. interval)</td>
<td>50th (95% conf. interval)</td>
</tr>
<tr>
<td><strong>Males and Females</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, Children 1–5 years, women 12–49 years</td>
<td>33.5 (31.4 – 35.7)</td>
<td>5.49 (4.69 – 6.46)</td>
<td>33.7 (31.8 – 35.8)</td>
</tr>
<tr>
<td>1–5 years</td>
<td>30.8 (28.9 – 32.8)</td>
<td>11.4 (9.51 – 14.2)</td>
<td>30.7 (28.7 – 32.7)</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1–5 years</td>
<td>30.0 (27.3 – 32.9)</td>
<td>10.6† (5.39 – 14.4)</td>
<td>29.6 (26.6 – 33.4)</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 1–5, 12–49 years</td>
<td>33.8 (31.5 – 36.2)</td>
<td>5.26 (4.56 – 6.25)</td>
<td>34.1 (32.1 – 36.9)</td>
</tr>
<tr>
<td>1–5 years</td>
<td>31.7 (29.8 – 33.7)</td>
<td>12.4† (9.78 – 14.6)</td>
<td>31.6 (29.1 – 33.6)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>28.2 (25.5 – 31.2)</td>
<td>6.61 (4.97 – 7.55)</td>
<td>31.1 (27.4 – 33.7)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>30.1 (27.9 – 32.4)</td>
<td>5.02† (4.22 – 6.08)</td>
<td>31.1 (28.4 – 34.1)</td>
</tr>
<tr>
<td>40–49 years</td>
<td>49.6 (40.4 – 61.0)</td>
<td>4.31† (&lt; LOD – 8.31)</td>
<td>53.5 (42.2 – 63.9)</td>
</tr>
</tbody>
</table>

< LOD means less than the limit of detection, which may vary for some compounds by year. See Appendix D for LOD.

† Estimate is subject to greater uncertainty due to small cell size.

### Table 3.1.a.5. Serum ferritin: Non-Hispanic whites

Geometric mean and selected percentiles of serum concentrations (in ng/mL) for non-Hispanic white children aged 1–5 years and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th></th>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>5th (95% conf. interval)</td>
<td>50th (95% conf. interval)</td>
</tr>
<tr>
<td><strong>Males and Females</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, Children 1–5 years, women 12–49 years</td>
<td>37.5 (35.5 – 39.6)</td>
<td>8.07 (6.52 – 8.85)</td>
<td>38.2 (35.9 – 39.8)</td>
</tr>
<tr>
<td>1–5 years</td>
<td>25.9 (24.2 – 27.7)</td>
<td>9.30 (8.13 – 10.0)</td>
<td>26.3 (24.4 – 28.1)</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1–5 years</td>
<td>26.1 (23.8 – 28.6)</td>
<td>9.13 (4.71 – 10.5)</td>
<td>27.1 (24.3 – 29.7)</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 1–5, 12–49 years</td>
<td>38.5 (36.3 – 40.7)</td>
<td>7.96 (6.36 – 8.78)</td>
<td>39.4 (37.2 – 41.0)</td>
</tr>
<tr>
<td>1–5 years</td>
<td>25.6 (23.4 – 27.9)</td>
<td>9.40† (5.96 – 10.3)</td>
<td>25.5 (23.4 – 27.8)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>30.0 (27.7 – 32.6)</td>
<td>6.88 (4.67 – 8.55)</td>
<td>33.0 (31.1 – 34.9)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>41.0 (37.8 – 44.5)</td>
<td>8.75 (7.16 – 10.1)</td>
<td>42.3 (39.2 – 47.0)</td>
</tr>
<tr>
<td>40–49 years</td>
<td>43.6 (38.3 – 49.6)</td>
<td>6.61 (4.82 – 8.43)</td>
<td>46.1 (39.7 – 51.2)</td>
</tr>
</tbody>
</table>

† Estimate is subject to greater uncertainty due to small cell size.
Table 3.1.b. Serum ferritin: Concentrations by survey cycle

Geometric mean and selected percentiles of serum concentrations (in ng/mL) for children aged 1–5 and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 1999–2006.

<table>
<thead>
<tr>
<th>Race/ethnicity (Children 1–5 years, women 12–49 years)</th>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (Children 1–5 years, women 12–49 years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999–2000</td>
<td>38.8 (36.7 – 41.0)</td>
<td>8.06 (5.23 – 9.99)</td>
<td>2919</td>
</tr>
<tr>
<td>2001–2002</td>
<td>36.1 (34.2 – 38.0)</td>
<td>5.23 **</td>
<td>3365</td>
</tr>
<tr>
<td>2003–2004</td>
<td>36.4 (34.7 – 38.3)</td>
<td>7.70 (5.80 – 8.58)</td>
<td>2981</td>
</tr>
<tr>
<td>2005–2006</td>
<td>35.0 (32.9 – 37.2)</td>
<td>6.46 (5.69 – 7.19)</td>
<td>3031</td>
</tr>
</tbody>
</table>

**Age group**

| 1–5 years (Children)                                  |                                    |                                          |             |
| 1999–2000                                             | 28.7 (26.9 – 30.7)                  | 10.6 (5.95 – 13.5)                      | 680         |
| 2001–2002                                             | 27.9 (25.6 – 30.5)                  | 6.43 (5.23 – 9.79)                      | 843         |
| 2003–2004                                             | 25.2 (23.7 – 26.8)                  | 9.27 (8.08 – 9.76)                      | 796         |
| 2005–2006                                             | 27.6 (26.0 – 29.2)                  | 8.95 (7.95 – 9.78)                      | 686         |

| 12–19 years (Women)                                   |                                    |                                          |             |
| 1999–2000                                             | 32.5 (29.6 – 35.8)                  | 9.26 (5.23 – 10.4)                      | 1048        |
| 2003–2004                                             | 28.0 (25.5 – 30.7)                  | 6.11 (4.43 – 7.97)                      | 998         |
| 2005–2006                                             | 30.6 (28.6 – 32.8)                  | 7.21 (5.52 – 8.79)                      | 993         |

| 20–39 years (Women)                                   |                                    |                                          |             |
| 1999–2000                                             | 40.0 (36.0 – 44.4)                  | 5.23 **                                 | 838         |
| 2001–2002                                             | 37.8 (35.2 – 40.5)                  | 5.23 **                                 | 992         |
| 2003–2004                                             | 39.8 (37.1 – 42.7)                  | 8.40 (7.52 – 9.20)                      | 822         |
| 2005–2006                                             | 36.5 (33.5 – 39.9)                  | 5.60 (4.70 – 7.17)                      | 958         |

| 40–49 years (Women)                                   |                                    |                                          |             |
| 1999–2000                                             | 50.3 (43.6 – 57.9)                  | 9.15 (5.23 – 12.1)                      | 353         |
| 2001–2002                                             | 43.7 (39.3 – 48.6)                  | 5.23 **                                 | 410         |
| 2003–2004                                             | 46.6 (39.9 – 54.4)                  | 5.16 (4.21 – 8.44)                      | 365         |
| 2005–2006                                             | 40.0 (34.5 – 46.3)                  | 6.26 (4.89 – 6.96)                      | 394         |

**Gender**

| Males (1–5 years)                                     |                                    |                                          |             |
| 1999–2000                                             | 27.4 (25.4 – 29.9)                  | 10.8 (6.11 – 13.1)                      | 377         |
| 2001–2002                                             | 26.1 (23.4 – 29.0)                  | 5.23 **                                 | 428         |
| 2003–2004                                             | 25.0 (23.1 – 27.1)                  | 9.19 (6.68 – 10.2)                      | 415         |
| 2005–2006                                             | 27.8 (25.8 – 29.9)                  | 8.71 (8.18 – 9.54)                      | 342         |

| Females (1–5, 12–49 years)                            |                                    |                                          |             |
| 1999–2000                                             | 40.0 (37.7 – 42.5)                  | 7.86 (5.23 – 9.85)                      | 2,542       |
| 2001–2002                                             | 37.0 (35.2 – 38.9)                  | 5.23 **                                 | 2,937       |
| 2003–2004                                             | 37.7 (35.6 – 39.8)                  | 7.60 (5.49 – 8.51)                      | 2,743       |
| 2005–2006                                             | 35.6 (33.4 – 37.9)                  | 6.31 (5.46 – 7.04)                      | 2,566       |

| Race/ethnicity (Children 1–5 years, women 12–49 years) |                                    |                                          |             |
| Mexican Americans                                     |                                    |                                          |             |
| 1999–2000                                             | 29.0 (26.6 – 31.6)                  | 5.23 **                                 | 1,077       |
| 2001–2002                                             | 27.9 (25.6 – 30.4)                  | 5.23 **                                 | 967         |
| 2003–2004                                             | 32.0 (27.4 – 37.4)                  | 6.36 (4.30 – 7.98)                      | 793         |
| 2005–2006                                             | 28.4 (25.7 – 31.4)                  | 4.57 (4.01 – 5.22)                      | 911         |
| Non-Hispanic Blacks                                   |                                    |                                          |             |
| 1999–2000                                             | 38.5 (34.3 – 43.3)                  | 5.23 **                                 | 690         |
| 2001–2002                                             | 35.8 (31.0 – 41.3)                  | 3.61 (32.7 – 40.2)                      | 855         |
| 2003–2004                                             | 34.1 (30.5 – 38.2)                  | 5.74 (4.17 – 7.50)                      | 870         |
| 2005–2006                                             | 32.7 (30.5 – 35.1)                  | 5.35 (4.67 – 6.15)                      | 806         |
| Non-Hispanic Whites                                   |                                    |                                          |             |
| 1999–2000                                             | 41.1 (38.4 – 44.0)                  | 9.77 (5.23 – 12.4)                      | 838         |
| 2001–2002                                             | 37.0 (34.2 – 40.1)                  | 6.86 (5.23 – 8.38)                      | 1,236       |
| 2003–2004                                             | 37.7 (35.1 – 40.5)                  | 8.37 (4.70 – 10.0)                      | 1,069       |
| 2005–2006                                             | 37.3 (34.1 – 40.7)                  | 7.57 (6.33 – 8.66)                      | 1,020       |

**The minimum value is reported. The desired percentile does not exist because it is less than the estimated cumulative distribution evaluated at the minimum.**

**NOTE:**
Figure 3.1.b. Serum ferritin: Concentrations by survey cycle
Selected percentiles in ng/mL (95% confidence intervals), National Health and Nutrition Examination Survey, 1999–2006
Table 3.1.c.1. Serum ferritin: Prevalence


<table>
<thead>
<tr>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Children, 1–5 years</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1,482</td>
<td>8.9 (7.1 – 11.2)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>757</td>
<td>9.2 (7.1 – 11.9)</td>
</tr>
<tr>
<td>Females</td>
<td>725</td>
<td>8.6 (6.2 – 11.8)</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexican Americans</td>
<td>468</td>
<td>11.4 (8.6 – 15.1)</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td>429</td>
<td>4.9 (3.1 – 7.8)</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td>416</td>
<td>9.8 (6.9 – 13.7)</td>
</tr>
</tbody>
</table>
Table 3.1.c.2. Serum ferritin: Prevalence
Prevalence (in percent) of low serum ferritin concentration (< 15 ng/mL) for women in the U.S. population aged 12–49 years, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th></th>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Women, 12–49 years</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12–19 years</td>
<td>1,991</td>
<td>15.2 (12.4 – 18.4)</td>
<td>2,462,000</td>
</tr>
<tr>
<td>20–49 years</td>
<td>2,539</td>
<td>13.2 (11.8 – 14.8)</td>
<td>8,299,000</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexican Americans</td>
<td>1,236</td>
<td>18.6 (14.9 – 23.0)</td>
<td>1,427,000</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td>1,247</td>
<td>19.9 (17.9 – 22.1)</td>
<td>2,140,000</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td>1,673</td>
<td>11.3 (9.2 – 13.9)</td>
<td>5,805,000</td>
</tr>
</tbody>
</table>
Table 3.1.c.3. Serum ferritin: Prevalence
Prevalence (in percent) of high serum ferritin concentration (> 150 ng/mL) for women in the U.S. population aged 12–49 years, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Women, 12–49 years</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Age group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12–19 years</td>
<td>1,991</td>
<td>0.9‡ (0.5 – 1.8)</td>
</tr>
<tr>
<td>20–49 years</td>
<td>2,539</td>
<td>6.2 (5.0 – 7.7)</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexican Americans</td>
<td>1,236</td>
<td>4.2 (2.5 – 7.2)</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td>1,247</td>
<td>7.1 (5.0 – 9.9)</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td>1,673</td>
<td>4.9 (3.7 – 6.3)</td>
</tr>
</tbody>
</table>

‡ Estimate flagged: 30% ≤ RSE < 40% for the prevalence estimate.
**Table 3.1.d.1. Serum ferritin: Prevalence by survey cycle**

Prevalence (in percent) of low serum ferritin concentration (< 12 ng/mL) for children in the U.S. population aged 1–5 years, National Health and Nutrition Examination Survey, 1999–2006.

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Children, 1–5 years</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999–2000</td>
<td>680</td>
<td>5.7 (3.3 – 9.6)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>843</td>
<td>10.0 (7.0 – 13.9)</td>
</tr>
<tr>
<td>2003–2004</td>
<td>796</td>
<td>9.0 (6.6 – 12.3)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>686</td>
<td>8.8 (6.0 – 12.8)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999–2000</td>
<td>377</td>
<td>5.9 (3.3 – 10.4)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>428</td>
<td>13.3 (8.6 – 20.1)</td>
</tr>
<tr>
<td>2003–2004</td>
<td>415</td>
<td>9.4 (6.6 – 13.3)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>342</td>
<td>9.0 (5.8 – 13.8)</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999–2000</td>
<td>303</td>
<td>5.5‡ (2.4 – 12.0)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>415</td>
<td>6.5 (4.3 – 9.6)</td>
</tr>
<tr>
<td>2003–2004</td>
<td>381</td>
<td>8.6 (5.6 – 12.8)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>344</td>
<td>8.6 (4.8 – 14.9)</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mexican Americans</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999–2000</td>
<td>269</td>
<td>11.7 (7.7 – 17.4)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>246</td>
<td>10.1 (7.4 – 13.6)</td>
</tr>
<tr>
<td>2003–2004</td>
<td>230</td>
<td>12.5 (7.6 – 19.8)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>238</td>
<td>10.2 (8.1 – 12.8)</td>
</tr>
<tr>
<td><strong>Non-Hispanic Blacks</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999–2000</td>
<td>168</td>
<td>4.7 (2.6 – 8.4)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>247</td>
<td>6.0 (3.1 – 11.3)</td>
</tr>
<tr>
<td>2003–2004</td>
<td>252</td>
<td>3.4‡ (1.7 – 6.9)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>177</td>
<td>6.0 (3.1 – 11.3)</td>
</tr>
<tr>
<td><strong>Non-Hispanic Whites</strong></td>
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</tr>
<tr>
<td>1999–2000</td>
<td>161</td>
<td>2.9† (1.3 – 6.1)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>259</td>
<td>11.9 (7.1 – 19.2)</td>
</tr>
<tr>
<td>2003–2004</td>
<td>230</td>
<td>9.4 (5.5 – 15.5)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>186</td>
<td>10.3 (6.1 – 16.7)</td>
</tr>
</tbody>
</table>

‡ Estimate flagged: 30% ≤ RSE < 40% for the prevalence estimate.
§ Estimate suppressed: RSE ≥ 40% for the prevalence estimate.
Table 3.1.d.2. Serum ferritin: Prevalence by survey cycle

Prevalence (in percent) of low serum ferritin concentration (< 15 ng/mL) for women in the U.S. population aged 12–49 years, National Health and Nutrition Examination Survey, 1999–2006.

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Women, 12–49 years</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999–2000</td>
<td>2,239</td>
<td>11.4 (9.4 – 13.9)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>2,522</td>
<td>13.9 (12.2 – 15.8)</td>
</tr>
<tr>
<td>2003–2004</td>
<td>2,185</td>
<td>13.2 (10.7 – 16.3)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>2,345</td>
<td>14.0 (12.6 – 15.5)</td>
</tr>
<tr>
<td><strong>Age group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12–19 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999–2000</td>
<td>1,048</td>
<td>11.5 (8.5 – 15.3)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>1,120</td>
<td>13.9 (11.2 – 17.1)</td>
</tr>
<tr>
<td>2003–2004</td>
<td>998</td>
<td>17.4 (12.8 – 23.3)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>993</td>
<td>12.9 (10.0 – 16.5)</td>
</tr>
<tr>
<td>20–49 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999–2000</td>
<td>1,191</td>
<td>11.4 (9.2 – 14.2)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>1,402</td>
<td>13.9 (12.0 – 16.0)</td>
</tr>
<tr>
<td>2003–2004</td>
<td>1,187</td>
<td>12.2 (9.7 – 15.2)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>1,352</td>
<td>14.2 (12.8 – 15.7)</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexican Americans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999–2000</td>
<td>808</td>
<td>18.8 (12.3 – 27.5)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>721</td>
<td>21.9 (18.8 – 25.4)</td>
</tr>
<tr>
<td>2003–2004</td>
<td>563</td>
<td>16.7 (11.7 – 23.2)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>673</td>
<td>20.6 (15.3 – 27.2)</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999–2000</td>
<td>522</td>
<td>16.4 (11.2 – 23.4)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>608</td>
<td>19.5 (12.3 – 29.6)</td>
</tr>
<tr>
<td>2003–2004</td>
<td>618</td>
<td>19.1 (16.4 – 22.0)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>629</td>
<td>20.7 (17.5 – 24.4)</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999–2000</td>
<td>677</td>
<td>9.1 (6.7 – 12.2)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>977</td>
<td>11.6 (9.5 – 14.2)</td>
</tr>
<tr>
<td>2003–2004</td>
<td>839</td>
<td>11.8 (8.3 – 16.5)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>834</td>
<td>10.9 (8.5 – 13.8)</td>
</tr>
</tbody>
</table>
Table 3.1.d.3. Serum ferritin: Prevalence by survey cycle
Prevalence (in percent) of low serum ferritin concentration (< 15 ng/mL) for males in the U.S. population aged 6 years and older, National Health and Nutrition Examination Survey, 1999–2002.

<table>
<thead>
<tr>
<th>Males, 6 years and older</th>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999–2000</td>
<td>3,488</td>
<td>1.1 (0.6 – 2.0)</td>
<td>1,323,000</td>
</tr>
<tr>
<td>2001–2002</td>
<td>3,849</td>
<td>1.3 (0.9 – 1.7)</td>
<td>1,576,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age group</th>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>6–11 years</td>
<td>1999–2000</td>
<td>1,078</td>
<td>2.1 (1.0 – 4.2)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>1,094</td>
<td>2.8 (1.4 – 5.4)</td>
<td>463,000†</td>
</tr>
<tr>
<td>12–19 years</td>
<td>1999–2000</td>
<td>1,078</td>
<td>2.1 (1.0 – 4.2)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>1,094</td>
<td>2.8 (1.4 – 5.4)</td>
<td>463,000†</td>
</tr>
<tr>
<td>20–39 years</td>
<td>1999–2000</td>
<td>1,078</td>
<td>2.1 (1.0 – 4.2)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>1,094</td>
<td>2.8 (1.4 – 5.4)</td>
<td>463,000†</td>
</tr>
<tr>
<td>40–59 years</td>
<td>1999–2000</td>
<td>1,078</td>
<td>2.1 (1.0 – 4.2)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>1,094</td>
<td>2.8 (1.4 – 5.4)</td>
<td>463,000†</td>
</tr>
<tr>
<td>60 years and older</td>
<td>1999–2000</td>
<td>1,078</td>
<td>2.1 (1.0 – 4.2)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>1,094</td>
<td>2.8 (1.4 – 5.4)</td>
<td>463,000†</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race/ethnicity</th>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mexican Americans</td>
<td>1999–2000</td>
<td>1,196</td>
<td>1.0 (0.5 – 1.6)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>958</td>
<td>0.7 (0.3 – 1.5)</td>
<td>77,000‡</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td>1999–2000</td>
<td>781</td>
<td>1.3 (0.7 – 2.7)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>921</td>
<td>1.3 (0.7 – 2.7)</td>
<td>187,000‡</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td>1999–2000</td>
<td>1,223</td>
<td>1.3 (0.6 – 2.7)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>1,678</td>
<td>1.3 (0.9 – 1.9)</td>
<td>1,159,000</td>
</tr>
</tbody>
</table>

† Estimate flagged: 30% ≤ RSE < 40% for the prevalence estimate.
§ Estimate suppressed: RSE ≥ 40% for the prevalence estimate.
### Table 3.1.d.4. Serum ferritin: Prevalence by survey cycle

Prevalence (in percent) of high serum ferritin concentration (> 150 ng/mL) for women in the U.S. population aged 12–49 years, National Health and Nutrition Examination Survey, 1999–2006.

<table>
<thead>
<tr>
<th>Women, 12–49 years</th>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999–2000</td>
<td>2,239</td>
<td>5.3 (4.0 – 7.0)</td>
<td>4,069,000</td>
</tr>
<tr>
<td>2001–2002</td>
<td>2,522</td>
<td>5.6 (4.5 – 7.0)</td>
<td>4,374,000</td>
</tr>
<tr>
<td>2003–2004</td>
<td>2,185</td>
<td>6.0 (4.7 – 7.5)</td>
<td>4,711,000</td>
</tr>
<tr>
<td>2005–2006</td>
<td>2,345</td>
<td>4.4 (2.9 – 6.6)</td>
<td>3,470,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age group</th>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>12–19 years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999–2000</td>
<td>1,048</td>
<td>§</td>
<td>§</td>
</tr>
<tr>
<td>2001–2002</td>
<td>1,120</td>
<td>§</td>
<td>§</td>
</tr>
<tr>
<td>2003–2004</td>
<td>998</td>
<td>§</td>
<td>§</td>
</tr>
<tr>
<td>2005–2006</td>
<td>993</td>
<td>1.4† (0.6 – 3.2)</td>
<td>237,000‡</td>
</tr>
<tr>
<td>20–49 years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999–2000</td>
<td>1,191</td>
<td>6.3 (4.8 – 8.3)</td>
<td>3,878,000</td>
</tr>
<tr>
<td>2001–2002</td>
<td>1,402</td>
<td>6.8 (5.3 – 8.5)</td>
<td>4,196,000</td>
</tr>
<tr>
<td>2003–2004</td>
<td>1,187</td>
<td>7.3 (5.9 – 9.1)</td>
<td>4,600,000</td>
</tr>
<tr>
<td>2005–2006</td>
<td>1,352</td>
<td>5.1 (3.2 – 7.9)</td>
<td>3,202,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race/ethnicity</th>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mexican Americans</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999–2000</td>
<td>808</td>
<td>3.7† (1.7 – 7.9)</td>
<td>224,000‡</td>
</tr>
<tr>
<td>2001–2002</td>
<td>721</td>
<td>3.5 (1.8 – 6.8)</td>
<td>249,000</td>
</tr>
<tr>
<td>2003–2004</td>
<td>563</td>
<td>5.6† (2.7 – 11.3)</td>
<td>429,000‡</td>
</tr>
<tr>
<td>2005–2006</td>
<td>673</td>
<td>2.9† (1.4 – 5.7)</td>
<td>226,000‡</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999–2000</td>
<td>522</td>
<td>7.8 (5.2 – 11.6)</td>
<td>840,000</td>
</tr>
<tr>
<td>2001–2002</td>
<td>608</td>
<td>7.7 (5.0 – 11.8)</td>
<td>828,000</td>
</tr>
<tr>
<td>2003–2004</td>
<td>618</td>
<td>8.3 (4.6 – 14.7)</td>
<td>895,000</td>
</tr>
<tr>
<td>2005–2006</td>
<td>629</td>
<td>5.7 (4.2 – 7.9)</td>
<td>625,000</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999–2000</td>
<td>677</td>
<td>5.7 (4.1 – 8.0)</td>
<td>3,000,000</td>
</tr>
<tr>
<td>2001–2002</td>
<td>977</td>
<td>5.0 (3.4 – 7.2)</td>
<td>2,579,000</td>
</tr>
<tr>
<td>2003–2004</td>
<td>839</td>
<td>5.7 (4.1 – 7.8)</td>
<td>2,926,000</td>
</tr>
<tr>
<td>2005–2006</td>
<td>834</td>
<td>4.0 (2.5 – 6.3)</td>
<td>2,026,000</td>
</tr>
</tbody>
</table>

‡ Estimate flagged: 30% ≤ RSE < 40% for the prevalence estimate
§ Estimate suppressed: RSE ≥ 40% for the prevalence estimate
Table 3.1.d.5. Serum ferritin: Prevalence by survey cycle
Prevalence (in percent) of high serum ferritin concentration (> 200 ng/mL) for males in the U.S. population aged 12 years and older, National Health and Nutrition Examination Survey, 1999–2002.

<table>
<thead>
<tr>
<th>Males, 12 years and older</th>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999–2000</td>
<td>3,025</td>
<td>31.8 (27.7 – 36.3)</td>
<td>34,391,000</td>
</tr>
<tr>
<td>2001–2002</td>
<td>3,340</td>
<td>32.7 (30.1 – 35.5)</td>
<td>36,644,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age group</th>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>12–19 years</td>
<td>1,078</td>
<td>3.3 (1.8 – 6.0)</td>
<td>538,000</td>
</tr>
<tr>
<td>20–39 years</td>
<td>1,094</td>
<td>1.7 (1.0 – 2.9)</td>
<td>283,000</td>
</tr>
<tr>
<td>40–59 years</td>
<td>632</td>
<td>33.1 (26.8 – 40.1)</td>
<td>12,720,000</td>
</tr>
<tr>
<td>60 years and older</td>
<td>724</td>
<td>31.0 (27.1 – 35.1)</td>
<td>12,101,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race/ethnicity</th>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mexican Americans</td>
<td>998</td>
<td>27.4 (23.1 – 32.1)</td>
<td>2,155,000</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td>819</td>
<td>25.8 (21.3 – 31.0)</td>
<td>2,430,000</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td>652</td>
<td>37.8 (32.8 – 43.2)</td>
<td>4,574,000</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td>746</td>
<td>33.7 (28.7 – 39.2)</td>
<td>4,079,000</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td>1,122</td>
<td>32.4 (27.5 – 37.6)</td>
<td>25,539,000</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td>1,518</td>
<td>33.1 (29.9 – 36.5)</td>
<td>26,398,000</td>
</tr>
</tbody>
</table>
### Table 3.2.a.1. Serum soluble transferrin receptor: Concentrations

Geometric mean and selected percentiles of serum concentrations (in mg/L) for children aged 1–5 years and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.5th</td>
<td>5th</td>
<td>50th</td>
</tr>
<tr>
<td>Total (Children 1–5 years, women 12–49 years)</td>
<td>3.57 (3.51 – 3.63)</td>
<td>1.94 (1.91 – 1.96)</td>
<td>2.11 (1.99 – 2.20)</td>
</tr>
<tr>
<td><strong>Age group</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1–5 years (Children)</td>
<td>4.30 (4.24 – 4.37)</td>
<td>2.84 (2.73 – 2.90)</td>
<td>2.98 (2.91 – 3.06)</td>
</tr>
<tr>
<td>12–19 years (Women)</td>
<td>3.50 (3.44 – 3.55)</td>
<td>2.12 (1.96 – 2.21)</td>
<td>2.27 (2.20 – 2.35)</td>
</tr>
<tr>
<td>20–39 years (Women)</td>
<td>3.42 (3.36 – 3.49)</td>
<td>1.91 (1.85 – 1.94)</td>
<td>2.02 (1.95 – 2.13)</td>
</tr>
<tr>
<td>40–49 years (Women)</td>
<td>3.52 (3.38 – 3.65)</td>
<td>1.91 (1.71 – 1.95)</td>
<td>1.97 (1.93 – 2.05)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males (1–5 years)</td>
<td>4.38 (4.28 – 4.48)</td>
<td>2.93 (2.75 – 2.98)</td>
<td>3.06 (2.95 – 3.18)</td>
</tr>
<tr>
<td>Females (1–5, 12–49 years)</td>
<td>3.51 (3.45 – 3.57)</td>
<td>1.93 (1.91 – 1.95)</td>
<td>2.07 (1.97 – 2.18)</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong></td>
<td>3.62 (3.53 – 3.72)</td>
<td>1.97 (1.93 – 2.03)</td>
<td>2.16 (2.06 – 2.24)</td>
</tr>
<tr>
<td>Mexican Americans</td>
<td>4.19 (4.10 – 4.29)</td>
<td>2.17 (1.97 – 2.33)</td>
<td>2.47 (2.31 – 2.57)</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td>3.43 (3.35 – 3.52)</td>
<td>1.92 (1.89 – 1.94)</td>
<td>2.02 (1.94 – 2.17)</td>
</tr>
</tbody>
</table>
Figure 3.2.a. Serum soluble transferrin receptor: Concentrations by age group
Geometric mean (95% confidence interval), National Health and Nutrition Examination Survey, 2003–2006

[Graphs showing serum soluble transferrin receptor concentrations by age group for Overall, Mexican Americans, Non-Hispanic Blacks, and Non-Hispanic Whites, separated by gender (Females and Males).]
Table 3.2.a.2. Serum soluble transferrin receptor: Total population
Geometric mean and selected percentiles of serum concentrations (in mg/L) for children aged 1–5 years and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5th</td>
<td>50th</td>
</tr>
<tr>
<td><strong>Males and Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, Children 1–5 years, women 12–49 years</td>
<td>3.57 (3.51 – 3.63)</td>
<td>2.11 (1.99 – 2.20)</td>
</tr>
<tr>
<td>1–5 years</td>
<td>4.30 (4.24 – 4.37)</td>
<td>2.98 (2.91 – 3.06)</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td>4.38 (4.28 – 4.48)</td>
<td>3.06 (2.95 – 3.18)</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 1–5, 12–49 years</td>
<td>3.51 (3.45 – 3.57)</td>
<td>2.07 (1.97 – 2.18)</td>
</tr>
<tr>
<td>1–5 years</td>
<td>4.22 (4.12 – 4.31)</td>
<td>2.90 (2.83 – 3.00)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>3.50 (3.44 – 3.55)</td>
<td>2.27 (2.20 – 2.35)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>3.42 (3.36 – 3.49)</td>
<td>2.02 (1.95 – 2.13)</td>
</tr>
<tr>
<td>40–49 years</td>
<td>3.52 (3.38 – 3.65)</td>
<td>1.97 (1.93 – 2.05)</td>
</tr>
</tbody>
</table>

† Estimate is subject to greater uncertainty due to small cell size.

Table 3.2.a.3. Serum soluble transferrin receptor: Mexican Americans
Geometric mean and selected percentiles of serum concentrations (in mg/L) for Mexican-American children aged 1–5 years and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5th</td>
<td>50th</td>
</tr>
<tr>
<td><strong>Males and Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, Children 1–5 years, women 12–49 years</td>
<td>3.62 (3.53 – 3.72)</td>
<td>2.16 (2.06 – 2.24)</td>
</tr>
<tr>
<td>1–5 years</td>
<td>4.30 (4.17 – 4.43)</td>
<td>2.99 (2.94 – 3.07)</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td>4.38 (4.21 – 4.56)</td>
<td>3.09† (2.90 – 3.21)</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 1–5, 12–49 years</td>
<td>3.55 (3.45 – 3.65)</td>
<td>2.13 (2.01 – 2.22)</td>
</tr>
<tr>
<td>1–5 years</td>
<td>4.21 (4.08 – 4.35)</td>
<td>2.93† (2.85 – 3.07)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>3.57 (3.46 – 3.68)</td>
<td>2.26 (2.18 – 2.36)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>3.40 (3.27 – 3.54)</td>
<td>2.02 (1.93 – 2.12)</td>
</tr>
<tr>
<td>40–49 years</td>
<td>3.63 (3.32 – 3.96)</td>
<td>2.22† (1.80 – 2.30)</td>
</tr>
</tbody>
</table>

† Estimate is subject to greater uncertainty due to small cell size.
### Table 3.2.a.4. Serum soluble transferrin receptor: Non-Hispanic blacks

Geometric mean and selected percentiles of serum concentrations (in mg/L) for non-Hispanic black children aged 1–5 years and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Geometric mean</td>
<td>5th</td>
</tr>
<tr>
<td><strong>Males and Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, Children 1–5 years, women 12–49 years</td>
<td>4.19 (4.10–4.29)</td>
<td>2.47 (2.31–2.57)</td>
</tr>
<tr>
<td>1–5 years</td>
<td>4.55 (4.43–4.67)</td>
<td>3.11 (3.02–3.29)</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1–5 years</td>
<td>4.70 (4.56–4.86)</td>
<td>3.24† (3.06–3.37)</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 1–5, 12–49 years</td>
<td>4.15 (4.05–4.26)</td>
<td>2.43 (2.27–2.55)</td>
</tr>
<tr>
<td>1–5 years</td>
<td>4.40 (4.21–4.59)</td>
<td>3.05† (2.73–3.23)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>3.88 (3.77–4.00)</td>
<td>2.42 (2.25–2.52)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>4.23 (4.08–4.39)</td>
<td>2.41 (2.06–2.58)</td>
</tr>
<tr>
<td>40–49 years</td>
<td>4.17 (3.89–4.47)</td>
<td>2.34† (1.94–2.61)</td>
</tr>
<tr>
<td>† Estimate is subject to greater uncertainty due to small cell size.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 3.2.a.5. Serum soluble transferrin receptor: Non-Hispanic whites

Geometric mean and selected percentiles of serum concentrations (in mg/L) for non-Hispanic white children aged 1–5 years and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Geometric mean</td>
<td>5th</td>
</tr>
<tr>
<td><strong>Males and Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, Children 1–5 years, women 12–49 years</td>
<td>3.43 (3.35–3.52)</td>
<td>2.02 (1.94–2.17)</td>
</tr>
<tr>
<td>1–5 years</td>
<td>4.22 (4.11–4.32)</td>
<td>2.91 (2.78–3.04)</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1–5 years</td>
<td>4.31 (4.16–4.46)</td>
<td>2.98† (2.91–3.15)</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 1–5, 12–49 years</td>
<td>3.38 (3.30–3.47)</td>
<td>2.00 (1.97–2.05)</td>
</tr>
<tr>
<td>1–5 years</td>
<td>4.11 (3.96–4.27)</td>
<td>2.85† (2.64–2.97)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>3.40 (3.33–3.46)</td>
<td>2.25 (2.12–2.36)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>3.27 (3.18–3.36)</td>
<td>1.97 (1.94–2.01)</td>
</tr>
<tr>
<td>40–49 years</td>
<td>3.42 (3.26–3.59)</td>
<td>1.96 (1.92–2.01)</td>
</tr>
<tr>
<td>† Estimate is subject to greater uncertainty due to small cell size.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3.2.b. Serum soluble transferrin receptor: Concentrations by survey cycle

Geometric mean and selected percentiles of serum concentrations (in mg/L) for children aged 1–5 and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Total (Children 1–5 years, women 12–49 years)</th>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–5 years (Children)</td>
<td></td>
<td>2003–2004</td>
<td>3.63 (3.54 – 3.71)</td>
<td>2,831</td>
</tr>
<tr>
<td>12–19 years (Women)</td>
<td></td>
<td>2003–2004</td>
<td>3.57 (3.48 – 3.66)</td>
<td>803</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005–2006</td>
<td>3.43 (3.36 – 3.49)</td>
<td>958</td>
</tr>
<tr>
<td>20–39 years (Women)</td>
<td></td>
<td>2003–2004</td>
<td>3.49 (3.43 – 3.56)</td>
<td>357</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males (1–5 years)</td>
<td></td>
<td>2003–2004</td>
<td>4.54 (4.39 – 4.70)</td>
<td>358</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005–2006</td>
<td>4.21 (4.05 – 4.38)</td>
<td>340</td>
</tr>
<tr>
<td>Females (1–5, 12–49 years)</td>
<td></td>
<td>2003–2004</td>
<td>3.56 (3.47 – 3.65)</td>
<td>2,473</td>
</tr>
<tr>
<td>Race/ethnicity (Children 1–5 years, women 12–49 years)</td>
<td></td>
<td>2003–2004</td>
<td>3.63 (3.53 – 3.73)</td>
<td>734</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td></td>
<td>2003–2004</td>
<td>4.18 (4.04 – 4.33)</td>
<td>832</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td></td>
<td>2003–2004</td>
<td>3.51 (3.37 – 3.65)</td>
<td>1,026</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005–2006</td>
<td>3.36 (3.27 – 3.45)</td>
<td>1,022</td>
</tr>
</tbody>
</table>
Figure 3.2.b. Serum soluble transferrin receptor: Concentrations by survey cycle
Selected percentiles in mg/L (95% confidence intervals), National Health and Nutrition Examination Survey, 2003–2006
### Table 3.2.c. Serum soluble transferrin receptor: Prevalence

Prevalence (in percent) of high serum soluble transferrin receptor concentration (> 4.4 mg/L) for women in the U.S. population aged 12–49 years, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Women, 12–49 years</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4,481</td>
<td>18.9 (17.0 – 20.9)</td>
<td>14,918,000</td>
</tr>
<tr>
<td><strong>Age group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12–19 years</td>
<td>1,968</td>
<td>16.9 (14.7 – 19.3)</td>
</tr>
<tr>
<td>20–49 years</td>
<td>2,513</td>
<td>19.4 (17.3 – 21.6)</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexican Americans</td>
<td>1,221</td>
<td>19.0 (15.5 – 23.0)</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td>1,233</td>
<td>34.9 (31.6 – 38.4)</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td>1,657</td>
<td>16.0 (13.6 – 18.7)</td>
</tr>
</tbody>
</table>
Table 3.2.d. Serum soluble transferrin receptor: Prevalence by survey cycle

Prevalence (in percent) of high serum soluble transferrin receptor concentration (> 4.4 mg/L) for women in the U.S. population aged 12–49 years, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Women, 12–49 years</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>2,135</td>
<td>18.8 (16.3 – 21.6)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>2,346</td>
<td>18.9 (16.0 – 22.3)</td>
</tr>
<tr>
<td><strong>Age group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12–19 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>975</td>
<td>17.4 (14.0 – 21.3)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>993</td>
<td>16.4 (13.5 – 19.8)</td>
</tr>
<tr>
<td>20–49 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>1,160</td>
<td>19.2 (16.3 – 22.4)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>1,353</td>
<td>19.6 (16.4 – 23.2)</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexican Americans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>547</td>
<td>18.7 (13.3 – 25.7)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>674</td>
<td>19.2 (14.6 – 24.7)</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>604</td>
<td>33.2 (28.9 – 37.7)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>629</td>
<td>36.7 (31.6 – 42.1)</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>823</td>
<td>16.1 (12.5 – 20.5)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>834</td>
<td>15.8 (12.6 – 19.6)</td>
</tr>
</tbody>
</table>
Table 3.3.a.1. Body iron

Arithmetic mean and selected percentiles of body iron (in mg/kg) for children aged 1–5 years and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Arithmatic mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>5.16 (5.01 – 5.31)</td>
<td>5,845</td>
</tr>
<tr>
<td>Total (Children 1–5 years, women 12–49 years)</td>
<td>3.47 (3.31 – 3.63)</td>
<td>1,369</td>
</tr>
<tr>
<td>1–5 years (Children)</td>
<td>4.49 (4.26 – 4.72)</td>
<td>1,967</td>
</tr>
<tr>
<td>12–19 years (Women)</td>
<td>5.51 (5.29 – 5.73)</td>
<td>1,758</td>
</tr>
<tr>
<td>20–39 years (Women)</td>
<td>5.88 (5.46 – 6.30)</td>
<td>751</td>
</tr>
<tr>
<td>40–49 years (Women)</td>
<td>3.38 (3.17 – 3.59)</td>
<td>695</td>
</tr>
<tr>
<td>Females (1–5, 12–49 years)</td>
<td>5.30 (5.13 – 5.46)</td>
<td>5,150</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexican Americans</td>
<td>4.49 (4.10 – 4.88)</td>
<td>1,641</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td>4.37 (4.10 – 4.64)</td>
<td>1,633</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td>5.46 (5.24 – 5.69)</td>
<td>2,041</td>
</tr>
</tbody>
</table>

2.5th 5th 50th 95th 97.5th
-3.75 (-4.05 – -3.41) -1.83 (-2.60 – -1.41) 5.43 (5.32 – 5.58) 10.8 (10.6 – 11.2) 12.0 (11.5 – 12.5)
-3.78 (-4.06 – -3.46) -1.75 (-2.81 – -1.22) 5.88 (5.69 – 6.17) 10.7 (10.2 – 11.1) 11.6 (11.0 – 12.4)
-3.76 (-4.09 – -3.12) -1.75 (-2.81 – -1.22) 5.88 (5.69 – 6.17) 10.7 (10.2 – 11.1) 11.6 (11.0 – 12.4)
-3.74 (-4.06 – -3.11) -2.85 (-3.78 – -1.84) 6.37 (5.86 – 6.82) 12.4 (11.7 – 12.9) 13.1 (12.7 – 14.2)
-2.00 (-3.06 – -1.34) -1.69 (-3.30 – -1.25) -715 (-1.36 – -2.62) 3.52 (3.32 – 3.80) 6.91 (6.65 – 7.30) 7.33 (6.93 – 8.12)
-2.01 (-3.70 – -1.43) -3.78 (-4.06 – -3.50) -2.01 (-2.70 – -1.43) 5.65 (5.49 – 5.76) 11.0 (10.7 – 11.4) 12.1 (11.6 – 12.6)
-2.01 (-2.70 – -1.43) -3.78 (-4.06 – -3.50) -2.01 (-2.70 – -1.43) 5.65 (5.49 – 5.76) 11.0 (10.7 – 11.4) 12.1 (11.6 – 12.6)
Figure 3.3.a. Body iron: by age group
Arithmetic mean (95% confidence interval), National Health and Nutrition Examination Survey, 2003–2006

3. Trace Elements
Table 3.3.a.2. Body iron: Total population
Arithmetic mean and selected percentiles of body iron (in mg/kg) for children aged 1–5 years and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Arithmetic mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5th</td>
<td>50th</td>
</tr>
<tr>
<td><strong>Males and Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, Children 1–5 years, women 12–49 years</td>
<td>5.16 (5.01 – 5.31)</td>
<td>-1.83 (-2.60 – -1.41)</td>
</tr>
<tr>
<td>1–5 years</td>
<td>3.47 (3.31 – 3.63)</td>
<td>-6.48 (-1.26 – -1.59)</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td>3.38 (3.17 – 3.59)</td>
<td>-7.15 (-1.36 – -2.62)</td>
</tr>
<tr>
<td>Total, Children 1–5 years, women 12–49 years</td>
<td>5.30 (5.13 – 5.46)</td>
<td>-2.01 (-2.70 – -1.43)</td>
</tr>
<tr>
<td>1–5 years</td>
<td>3.57 (3.36 – 3.78)</td>
<td>-1.96 (-2.11 – -411)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>4.49 (4.26 – 4.72)</td>
<td>-1.59 (-2.69 – -763)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>5.51 (5.29 – 5.73)</td>
<td>-1.75 (-2.81 – -1.22)</td>
</tr>
<tr>
<td>40–49 years</td>
<td>5.88 (5.46 – 6.30)</td>
<td>-2.85 (-3.78 – -1.84)</td>
</tr>
</tbody>
</table>

† Estimate is subject to greater uncertainty due to small cell size.

Table 3.3.a.3. Body iron: Mexican Americans
Arithmetic mean and selected percentiles of body iron (in mg/kg) for Mexican American children aged 1–5 years and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Arithmetic mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5th</td>
<td>50th</td>
</tr>
<tr>
<td><strong>Males and Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, Children 1–5 years, women 12–49 years</td>
<td>4.49 (4.10 – 4.88)</td>
<td>-3.16 (-3.81 – -2.03)</td>
</tr>
<tr>
<td>1–5 years</td>
<td>3.16 (2.84 – 3.48)</td>
<td>-2.09 (-3.35 – -1.36)</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td>2.95 (2.48 – 3.41)</td>
<td>-2.71† (-4.72 – -1.59)</td>
</tr>
<tr>
<td>Total, Children 1–5 years, women 12–49 years</td>
<td>4.66 (4.23 – 5.10)</td>
<td>-3.17 (-3.82 – -1.90)</td>
</tr>
<tr>
<td>1–5 years</td>
<td>3.38 (3.04 – 3.72)</td>
<td>-1.88 (2.87 – 8.28)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>4.07 (3.76 – 4.39)</td>
<td>-1.76 (3.29 – 981)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>5.07 (4.48 – 5.67)</td>
<td>-3.15 (4.31 – 1.66)</td>
</tr>
<tr>
<td>40–49 years</td>
<td>4.89 (3.74 – 6.04)</td>
<td>-4.89† (6.96 – 3.40)</td>
</tr>
</tbody>
</table>

† Estimate is subject to greater uncertainty due to small cell size.
### Table 3.3.a.4. Body iron: Non-Hispanic blacks

Arithmetic mean and selected percentiles of body iron (in mg/kg) for non-Hispanic black children aged 1–5 years and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Arithmetic mean and selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Males and Females</strong></td>
<td></td>
</tr>
<tr>
<td>Total, Children 1–5 years, women 12–49 years</td>
<td>1,633</td>
</tr>
<tr>
<td>5th</td>
<td>4.37 (4.10 – 4.64)</td>
</tr>
<tr>
<td>50th</td>
<td>4.66 (4.30 – 5.05)</td>
</tr>
<tr>
<td>95th</td>
<td>11.0 (10.3 – 11.6)</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td></td>
</tr>
<tr>
<td>1–5 years</td>
<td>401</td>
</tr>
<tr>
<td>5th</td>
<td>3.83 (3.56 – 4.09)</td>
</tr>
<tr>
<td>50th</td>
<td>3.95 (3.78 – 4.25)</td>
</tr>
<tr>
<td>95th</td>
<td>7.51 (6.80 – 8.03)</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
</tr>
<tr>
<td>1–5 years</td>
<td>11.0</td>
</tr>
<tr>
<td>5th</td>
<td>3.63 (3.25 – 4.00)</td>
</tr>
<tr>
<td>50th</td>
<td>3.77 (3.17 – 4.19)</td>
</tr>
<tr>
<td>95th</td>
<td>6.90† (6.55 – 8.03)</td>
</tr>
</tbody>
</table>

† Estimate is subject to greater uncertainty due to small cell size.

### Table 3.3.a.5. Body iron: Non-Hispanic whites

Arithmetic mean and selected percentiles of body iron (in mg/kg) for non-Hispanic white children aged 1–5 years and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Arithmetic mean and selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Males and Females</strong></td>
<td></td>
</tr>
<tr>
<td>Total, Children 1–5 years, women 12–49 years</td>
<td>2,041</td>
</tr>
<tr>
<td>5th</td>
<td>5.46 (5.24 – 5.69)</td>
</tr>
<tr>
<td>50th</td>
<td>5.66 (5.49 – 5.81)</td>
</tr>
<tr>
<td>95th</td>
<td>10.9 (10.5 – 11.5)</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td></td>
</tr>
<tr>
<td>1–5 years</td>
<td>385</td>
</tr>
<tr>
<td>5th</td>
<td>3.51 (3.27 – 3.74)</td>
</tr>
<tr>
<td>50th</td>
<td>3.56 (3.34 – 3.92)</td>
</tr>
<tr>
<td>95th</td>
<td>6.89 (6.64 – 7.00)</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
</tr>
<tr>
<td>1–5 years</td>
<td>172</td>
</tr>
<tr>
<td>5th</td>
<td>3.42 (3.09 – 3.75)</td>
</tr>
<tr>
<td>50th</td>
<td>3.50 (3.06 – 4.01)</td>
</tr>
<tr>
<td>95th</td>
<td>6.91† (6.45 – 7.33)</td>
</tr>
</tbody>
</table>

† Estimate is subject to greater uncertainty due to small cell size.
Table 3.3.b. Body iron: By survey cycle
Arithmetic mean and selected percentiles of body iron (in mg/kg) for children aged 1–5 years and women aged 12–49 years in the U.S. population, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Arithmetic mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (Children 1–5 years, women 12–49 years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>5.21 (5.03 – 5.39)</td>
<td>-1.60 (-2.96 – -0.85)</td>
<td>2,826</td>
</tr>
<tr>
<td>2005–2006</td>
<td>5.11 (4.85 – 5.38)</td>
<td>-2.04 (-2.73 – -1.43)</td>
<td>3,019</td>
</tr>
<tr>
<td>1–5 years (Children)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>3.25 (3.01 – 3.50)</td>
<td>-651 (-1.73 – -1.14)</td>
<td>694</td>
</tr>
<tr>
<td>2005–2006</td>
<td>3.70 (3.47 – 3.94)</td>
<td>-642 (-1.65 – -0.80)</td>
<td>675</td>
</tr>
<tr>
<td>12–19 years (Women)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>4.27 (3.89 – 4.66)</td>
<td>-2.23 (-3.93 – -1.63)</td>
<td>974</td>
</tr>
<tr>
<td>2005–2006</td>
<td>4.71 (4.45 – 4.96)</td>
<td>-1.45 (-2.64 – -0.57)</td>
<td>993</td>
</tr>
<tr>
<td>20–39 years (Women)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>5.61 (5.33 – 5.89)</td>
<td>-1.21 (-2.14 – -0.35)</td>
<td>801</td>
</tr>
<tr>
<td>2005–2006</td>
<td>5.42 (5.04 – 5.79)</td>
<td>-2.55 (-3.91 – -1.41)</td>
<td>957</td>
</tr>
<tr>
<td>40–49 years (Women)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>6.22 (5.61 – 6.82)</td>
<td>-3.28 (-3.80 – -1.95)</td>
<td>357</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males (1–5 years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>3.11 (2.76 – 3.46)</td>
<td>-719 (-1.89 – -1.52)</td>
<td>358</td>
</tr>
<tr>
<td>2005–2006</td>
<td>3.68 (3.41 – 3.95)</td>
<td>-746 (-1.32 – -2.68)</td>
<td>337</td>
</tr>
<tr>
<td>Females (1–5, 12–49 years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>5.38 (5.18 – 5.58)</td>
<td>-1.76 (-3.18 – -1.14)</td>
<td>2,468</td>
</tr>
<tr>
<td>2005–2006</td>
<td>5.22 (4.94 – 5.49)</td>
<td>-2.20 (-2.98 – -1.52)</td>
<td>2,682</td>
</tr>
<tr>
<td>Mexican Americans</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>4.74 (4.13 – 5.35)</td>
<td>-2.05 (-3.57 – -1.13)</td>
<td>734</td>
</tr>
<tr>
<td>2005–2006</td>
<td>4.26 (3.78 – 4.73)</td>
<td>-3.70 (-5.21 – -2.73)</td>
<td>907</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>4.48 (4.02 – 4.94)</td>
<td>-3.79 (-5.06 – -2.47)</td>
<td>831</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>5.45 (5.14 – 5.75)</td>
<td>-903 (-3.69 – -2.05)</td>
<td>1,023</td>
</tr>
<tr>
<td>2005–2006</td>
<td>5.48 (5.12 – 5.85)</td>
<td>-1.39 (-2.45 – -0.93)</td>
<td>1,018</td>
</tr>
</tbody>
</table>
Figure 3.3.b. Body iron: By Survey Cycle
Selected percentiles in mg/kg (95% confidence intervals), National Health and Nutrition Examination Survey, 2003–2006

3. Trace Elements
### Table 3.3.c.1. Body iron: Prevalence

Prevalence (in percent) of low body iron (< 0 mg/kg) for children in the U.S. population aged 1–5 years, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th></th>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Children, 1–5 years</strong></td>
<td>1,369</td>
<td>6.7 (5.0 – 8.8)</td>
<td>1,350,000</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>695</td>
<td>7.8 (5.6 – 10.8)</td>
<td>807,000</td>
</tr>
<tr>
<td>Females</td>
<td>674</td>
<td>5.4 (3.4 – 8.3)</td>
<td>534,000</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexican Americans</td>
<td>422</td>
<td>10.9 (8.1 – 14.6)</td>
<td>333,000</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td>401</td>
<td>5.1 (3.0 – 8.6)</td>
<td>154,000</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td>385</td>
<td>5.8 (3.6 – 9.1)</td>
<td>670,000</td>
</tr>
</tbody>
</table>
**Table 3.3.c.2. Body iron: Prevalence**

Prevalence (in percent) of low body iron (< 0 mg/kg) for women in the U.S. population aged 12–49 years, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Women, 12–49 years</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4,476</td>
<td>9.5 (8.6 – 10.5)</td>
</tr>
<tr>
<td><strong>Age group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12–19 years</td>
<td>1,967</td>
<td>9.3 (7.4 – 11.6)</td>
</tr>
<tr>
<td>20–49 years</td>
<td>2,509</td>
<td>9.6 (8.6 – 10.7)</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexican Americans</td>
<td>1,219</td>
<td>13.2 (10.2 – 16.9)</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td>1,232</td>
<td>16.2 (13.9 – 18.7)</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td>1,656</td>
<td>7.4 (5.8 – 9.4)</td>
</tr>
</tbody>
</table>
Table 3.3.d.1. Body iron: Prevalence by survey cycle
Prevalence (in percent) of low body iron (< 0 mg/kg) for children in the U.S. population aged 1–5 years, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children, 1–5 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>694</td>
<td>6.5 (4.3 – 9.8)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>675</td>
<td>6.8 (4.5 – 10.2)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>358</td>
<td>8.3 (4.9 – 13.7)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>337</td>
<td>7.3 (4.7 – 11.1)</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>336</td>
<td>4.5 (2.7 – 7.4)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>338</td>
<td>6.3‡ (3.1 – 12.4)</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexican Americans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>187</td>
<td>13.3 (8.4 – 20.5)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>235</td>
<td>8.6 (6.0 – 12.1)</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>228</td>
<td>6.1‡ (3.1 – 11.8)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>173</td>
<td>§</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>201</td>
<td>4.6‡ (2.1 – 10.0)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>184</td>
<td>7.0 (3.8 – 12.5)</td>
</tr>
</tbody>
</table>

‡ Estimate flagged: 30% ≤ RSE < 40% for the prevalence estimate.
§ Estimate suppressed: RSE ≥ 40% for the prevalence estimate.
### Table 3.3.d.2. Body iron: Prevalence by survey cycle

Prevalence (in percent) of low body iron (< 0 mg/kg) for women in the U.S. population aged 12–49 years, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th></th>
<th>Sample size</th>
<th>Prevalence (95% conf. interval)</th>
<th>Estimated total number of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Women, 12–49 years</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>2,132</td>
<td>8.6 (7.0 – 10.4)</td>
<td>6,773,000</td>
</tr>
<tr>
<td>2005–2006</td>
<td>2,344</td>
<td>10.4 (9.3 – 11.7)</td>
<td>8,266,000</td>
</tr>
<tr>
<td><strong>Age group</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12–19 years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>974</td>
<td>9.0 (6.3 – 12.6)</td>
<td>1,455,000</td>
</tr>
<tr>
<td>2005–2006</td>
<td>993</td>
<td>9.6 (6.9 – 13.2)</td>
<td>1,576,000</td>
</tr>
<tr>
<td>20–49 years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>1,158</td>
<td>8.5 (6.8 – 10.5)</td>
<td>5,322,000</td>
</tr>
<tr>
<td>2005–2006</td>
<td>1,351</td>
<td>10.6 (9.5 – 11.9)</td>
<td>6,681,000</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexican Americans</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>547</td>
<td>11.2 (7.6 – 16.2)</td>
<td>857,000</td>
</tr>
<tr>
<td>2005–2006</td>
<td>672</td>
<td>15.1 (10.5 – 21.2)</td>
<td>1,193,000</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>603</td>
<td>16.0 (12.8 – 19.8)</td>
<td>1,720,000</td>
</tr>
<tr>
<td>2005–2006</td>
<td>629</td>
<td>16.3 (13.1 – 20.1)</td>
<td>1,777,000</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003–2004</td>
<td>822</td>
<td>6.9 (4.4 – 10.6)</td>
<td>3,530,000</td>
</tr>
<tr>
<td>2005–2006</td>
<td>834</td>
<td>8.0 (6.0 – 10.5)</td>
<td>4,023,000</td>
</tr>
</tbody>
</table>
References


Iodine

Background Information

Sources and Physiological Functions. Iodine, a trace element found in soil, is an essential component of the thyroid hormones involved in regulating the body's metabolic processes related to normal growth and development. Across the world, iodized salt and seafood are the major dietary sources of iodine. In the United States, where the addition of iodine to salt is not mandatory, most people get their iodine from dairy products and grains (bread) (Murray 2008). In the United States, salt is iodized with potassium iodide at 100 parts per million (76 milligram [mg] of iodine per kilogram [kg] of salt). Iodized salt is chosen by about 50–60% of the U.S. population (Institute of Medicine 2001). Still, most ingested salt comes from processed food (approximately 70%), which is typically not iodized in either the United States or in Canada (The Public Health Committee of the American Thyroid Association 2006). Dairy products have been identified as another important contributor to iodine status among reproductive-age women in the United States (Perrine 2010).

Health Effects. Iodine deficiency disorders include mental retardation, hypothyroidism, goiter, cretinism, and varying degrees of other growth and developmental abnormalities. Iodine deficiency is the most preventable cause of mental retardation in the world (World Health Organization 2007). Thyroid enlargement (goiter) is usually the earliest clinical feature of iodine deficiency. Thyroid hormone is particularly important in the development of the central nervous system during the fetal and early postnatal periods. In areas where iodized salt is common, iodine deficiency is rare. The most critical period for iodine sufficiency is in utero through the first two years of life, when thyroid hormones are required for normal brain development (World Health Organization 2007).

Excess iodine intake may also result in goiter, as well as in hyper- or hypothyroidism. High iodine intake has also been associated with increased risk for thyroid papillary cancer (Institute of Medicine 2001). For most people, iodine intake from usual foods and supplements is unlikely to exceed the tolerable upper intake level (1100 µg/day) (Institute of Medicine 2001).

Intake Recommendations. The Institute of Medicine recommends the following daily intake of iodine: 90 µg for children 1 to 8 years, 120 µg for children 9 to 13 years, 150 µg for adolescents (14 to 18 years) and for nonpregnant adults, 220 µg per day for pregnant women, and 290 µg per day during lactation (Institute of Medicine 2001). Dietary iodine requirements are higher in pregnancy because of increased thyroid hormone production, increased renal iodine excretion, and fetal iodine requirements (Glinoer 2007).

The World Health Organization (WHO) recommends the following daily intake of iodine: 90 µg for preschool children (0 to 59 months); 120 µg for schoolchildren (6 to 12 years); 150 µg for adolescents (above 12 years) and adults; and 250 µg for pregnant and lactating women (World Health Organization 2007). The American Thyroid Association recommends that North American women receive dietary supplements containing 150 µg iodine daily during pregnancy and lactation and that all prenatal vitamins contain 150 µg of iodine (Becker 2006). An Endocrine Society Clinical Practice Guideline on the management of thyroid dysfunction during...
pregnancy and postpartum recommends an average daily intake of 250 μg iodine for pregnant women (Abalovich 2007). These recommendations have not yet been widely adopted. A current survey of prenatal multivitamins marketed in the United States showed that 49% did not contain iodine (Leung 2009). Furthermore, the majority of women of childbearing age (> 80%) are not consuming supplements containing iodine (Gregory 2009).

**Biochemical Indicators.** Iodine deficiency develops when iodide intake is less than 20 μg/day (Beers 2006). Most dietary iodine absorbed in the body eventually appears in the urine; thus, urinary iodine excretion is recommended for assessing recent dietary iodine intake worldwide (World Health Organization 2007).

WHO categories for median urinary iodine concentrations in school-age children and adults (excluding pregnant and lactating women) are widely used to define iodine intake and nutrition status for populations (World Health Organization 2007). An additional adequacy criterion is that not more than 20% of samples from children and non-pregnant women be below 50 nanograms per milliliter (ng/mL) of iodine. These categories are useful for classifying population risk, but they are not categories to define individual risk for adverse health outcomes. The large day-to-day variations in urine iodine excretion, even among individuals with stable iodine intake, tend to offset one another when the sample includes an adequately large number (100–500 spot urine samples per group or subgroup) of representative individuals (Andersen 2008).

### Epidemiological criteria for assessing iodine nutrition based on median urinary iodine concentrations of school-age children (≥ 6 years)* (World Health Organization 2007)

<table>
<thead>
<tr>
<th>Median Urinary Iodine (ng/mL)</th>
<th>Iodine Intake</th>
<th>Iodine Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20</td>
<td>Insufficient</td>
<td>Severe iodine deficiency</td>
</tr>
<tr>
<td>20–49</td>
<td>Insufficient</td>
<td>Moderate iodine deficiency</td>
</tr>
<tr>
<td>50–99</td>
<td>Insufficient</td>
<td>Mild iodine deficiency</td>
</tr>
<tr>
<td>100–199</td>
<td>Adequate</td>
<td>Adequate iodine nutrition</td>
</tr>
<tr>
<td>200–299</td>
<td>Above requirements</td>
<td>Likely to provide adequate intake for pregnant/lactating women but may pose a slight risk of more than adequate intake in the overall population</td>
</tr>
<tr>
<td>≥ 300</td>
<td>Excessive</td>
<td>Risk for adverse health consequences (e.g., iodine-induced hyperthyroidism, autoimmune thyroid diseases)</td>
</tr>
</tbody>
</table>

* Applies to adults but not to pregnant and lactating women.

For pregnant women, median urinary iodine concentrations of 150–249 ng/mL represent adequate iodine intake (World Health Organization 2007; Andersson 2007). Median urinary iodine concentrations of < 150 ng/mL represent insufficient intake; 250–499 ng/mL represent an intake above requirements, and ≥ 500 ng/mL represent an excessive intake. For lactating women and children less than 2 years of age, median urinary iodine concentrations of 100 ng/mL represent adequate iodine intake, but no other categories of iodine intake are defined (World Health Organization 2007; Andersson 2007).

**Data in NHANES.** NHANES has measured urinary iodine since 1971. The NHANES III survey (1988–1994) showed a sizable decrease in urinary iodine concentrations compared to concentrations measured during NHANES I (1971–1974) (Hollowell 1998). This decline may have been due to the dairy industry’s effort in the mid-1980s to reduce the iodine residue in milk from feed supplements and iodophor sanitizing agents (Pennington 1996). Decreased concentrations of iodine in fruit-flavored breakfast cereals resulted from a ban on erythrosine (an iodine-containing food additive) in 1989.
dye) and could also have contributed to the decline in urinary iodine concentrations (Pennington 1996). Since 2000, urinary iodine has been measured in the continuous NHANES survey. Starting with NHANES 2000, CDC used a new method, inductively coupled plasma mass spectrometry (ICP-MS), to make these measurements (Caldwell 2003). This method produced comparable data to the established Sandell-Kolthoff spectrophotometric method used in NHANES III (Pino 1998). When CDC laboratory scientists measured urinary iodine concentrations in NHANES 2001–2002 (Caldwell 2005), 2003–2004 (Caldwell 2008), and 2005–2006 and 2007–2008 (Caldwell 2011), they found that the U.S. median urinary iodine concentration had stabilized since the initial drop that had occurred from NHANES I to NHANES III and that it represented adequate iodine intake for the overall population 6 years and older. The median (95% confidence interval) urinary iodine concentration for pregnant women [125 (86–198) ng/mL] was below the cutoff value of 150 ng/mL indicating iodine deficiency, however the sample was small (n = 184) (Caldwell 2011). Continued monitoring of the population for iodine sufficiency is warranted because of groups at risk for iodine deficiency disorders.

For more information about iodine, see the Institute of Medicine’s Dietary Reference Intake report (Institute of Medicine 2001).

Highlights

Urinary iodine concentrations in the U.S. population showed the following demographic patterns and characteristics:

- The lowest concentrations were observed in young women, while the highest concentrations were observed in children.
- No consistent pattern was observed with regard to race/ethnicity.
- Concentrations have been relatively stable since the late 1980’s.

The iodine intake of the U.S. population appeared to be adequate on the basis of median urinary iodine concentrations. However, women aged 20–39 years had the lowest iodine intake, just slightly above insufficient intake (Figure H.3.e). Young women merit special attention to ensure the best possible brain development of the fetus during pregnancy. While no age group had a median urinary iodine concentration that represented excessive iodine intake, boys 6–11 years of age had the highest intake, and the upper confidence limit of the median was just slightly within the range of excessive intake (Figure H.3.e).

![Figure H.3.e](image)

**Figure H.3.e.** Median concentrations of urinary iodine in the U.S. population aged 6 years and older by age group and gender associated with estimated iodine intake, National Health and Nutrition Examination Survey, 2001–2006.

Error bars represent 95% confidence intervals.
Urinary iodine concentrations have been relatively stable over almost two decades between 1988–2006 (Figure H.3.f). They increased slightly (< 20%) between 1988–1994 and 2001–2002 in the total population, in males, in females, and in non-Hispanic whites. However, they remained unchanged in non-Hispanic blacks and Mexican Americans.

**Figure H.3.f.** Age-adjusted geometric mean concentrations of urinary iodine in the U.S. population aged 6 years and older by gender or race/ethnicity, National Health and Nutrition Examination Survey, 1988–2006. Error bars represent 95% confidence intervals. Within a demographic group, bars not sharing a common letter differ (p < 0.05).

**Detailed Observations**

The selected observations mentioned below are derived from the uncorrected tables and figures presented next. The NHANES population is of sufficient size to allow group comparisons based on uncorrected data. Statements about categorical differences between demographic groups noted below are based on non-overlapping confidence limits from univariate analysis without adjusting for demographic variables (i.e., age, sex, race/ethnicity) or other determinants of these urine concentrations (i.e., dietary intake, supplement usage, smoking, BMI). A multivariate analysis may alter the size and statistical significance of these categorical differences. Furthermore, additional significant differences of smaller magnitude may be present despite their lack of mention here (e.g., if confidence limits slightly overlap or if differences are not statistically significant before covariate adjustment has occurred). For a selection of citations of descriptive NHANES papers related to these biochemical indicators of diet and nutrition, see Appendix G.

**Geometric mean concentrations (NHANES 2003–2006):**

- Urinary iodine concentrations followed a U-shaped age pattern, with the lowest concentrations seen in young and middle-aged adults (Table 3.4.a.1 and Figure 3.4.a).
- Females had lower urinary iodine concentrations than males (Table 3.4.a.1 and Figure 3.4.a).
- Non-Hispanic blacks had lower urinary iodine concentrations than either non-Hispanic whites or Mexican Americans (Table 3.4.a.1 and Figure 3.4.a).

**Changes in geometric mean concentrations across survey cycles:**

- We observed no change in urinary iodine concentrations between 2001 and 2006 (Table 3.4.b).
Table 3.4.a.1. Urinary iodine: Concentrations
Geometric mean and selected percentiles of urine concentrations (in ng/mL) for the total U.S. population aged 6 years and older, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Geometric mean (95% conf. interval)</th>
<th>2.5th</th>
<th>5th</th>
<th>50th</th>
<th>95th</th>
<th>97.5th</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>156 (148 – 163)</td>
<td>23.3 (19.4 – 26.0)</td>
<td>33.0 (29.0 – 36.5)</td>
<td>162 (154 – 170)</td>
<td>603 (565 – 676)</td>
<td>816 (719 – 1,040)</td>
<td>5,175</td>
</tr>
<tr>
<td>(Children 1–5 years, women 12–49 years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6–11 years</td>
<td>222 (201 – 245)</td>
<td>36.4 (25.8 – 43.0)</td>
<td>51.6 (37.5 – 55.9)</td>
<td>232 (208 – 270)</td>
<td>764 (631 – 1,080)</td>
<td>1,040 (756 – 6,960)</td>
<td>666</td>
</tr>
<tr>
<td>12–19 years</td>
<td>179 (161 – 199)</td>
<td>24.9 (18.0 – 30.8)</td>
<td>36.7 (25.0 – 45.7)</td>
<td>186 (171 – 203)</td>
<td>741 (644 – 903)</td>
<td>936 (808 – 1,240)</td>
<td>1,443</td>
</tr>
<tr>
<td>20–39 years</td>
<td>135 (126 – 144)</td>
<td>20.0 (17.6 – 23.8)</td>
<td>29.4 (22.5 – 33.6)</td>
<td>140 (129 – 149)</td>
<td>515 (453 – 614)</td>
<td>679 (599 – 872)</td>
<td>1,134</td>
</tr>
<tr>
<td>40–59 years</td>
<td>137 (128 – 147)</td>
<td>20.0 (13.2 – 26.0)</td>
<td>28.4 (21.5 – 35.2)</td>
<td>145 (136 – 156)</td>
<td>489 (457 – 574)</td>
<td>674 (556 – 906)</td>
<td>919</td>
</tr>
<tr>
<td>60 years and older</td>
<td>187 (170 – 205)</td>
<td>30.3 (25.9 – 37.7)</td>
<td>41.9 (36.9 – 49.0)</td>
<td>181 (168 – 202)</td>
<td>707 (616 – 1,080)</td>
<td>1,530 (1,050 – 4,320)</td>
<td>1,013</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>174 (164 – 185)</td>
<td>28.0 (22.4 – 32.9)</td>
<td>38.1 (34.9 – 42.5)</td>
<td>180 (172 – 189)</td>
<td>673 (581 – 760)</td>
<td>935 (743 – 1,260)</td>
<td>2,477</td>
</tr>
<tr>
<td>Females</td>
<td>140 (133 – 147)</td>
<td>20.0 (17.5 – 24.0)</td>
<td>28.5 (24.0 – 32.0)</td>
<td>144 (137 – 153)</td>
<td>571 (541 – 606)</td>
<td>762 (664 – 953)</td>
<td>2,698</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexican Americans</td>
<td>173 (161 – 185)</td>
<td>30.7 (19.0 – 38.6)</td>
<td>40.2 (34.0 – 49.4)</td>
<td>186 (173 – 195)</td>
<td>591 (539 – 730)</td>
<td>768 (687 – 1,130)</td>
<td>1,320</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td>141 (131 – 151)</td>
<td>28.7 (25.7 – 30.8)</td>
<td>38.2 (31.1 – 44.0)</td>
<td>141 (128 – 152)</td>
<td>482 (442 – 554)</td>
<td>606 (535 – 770)</td>
<td>1,363</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td>159 (151 – 168)</td>
<td>22.5 (18.9 – 25.8)</td>
<td>32.0 (27.9 – 36.6)</td>
<td>166 (156 – 176)</td>
<td>634 (570 – 714)</td>
<td>835 (731 – 1,170)</td>
<td>2,085</td>
</tr>
</tbody>
</table>
Figure 3.4.a. Urinary iodine: Concentrations by age group
Geometric mean (95% confidence interval), National Health and Nutrition Examination Survey, 2003–2006

Comparison of urinary iodine concentrations across different age groups and races/ethnicities.
### Table 3.4.a.2. Urinary iodine: Total population

Geometric mean and selected percentiles of urine concentrations (in ng/mL) for the total U.S. population aged 6 years and older, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10th</td>
<td>50th</td>
</tr>
<tr>
<td><strong>Males and Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 6 years and older</td>
<td>55.5 (41.9 – 59.3)</td>
<td>156 (148 – 163)</td>
</tr>
<tr>
<td>6–11 years</td>
<td>60.2 (49.8 – 65.0)</td>
<td>222 (201 – 245)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>66.6 (55.8 – 74.2)</td>
<td>179 (161 – 199)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>71.1 (60.4 – 81.9)</td>
<td>153 (126 – 144)</td>
</tr>
<tr>
<td>40–59 years</td>
<td>75.6 (64.9 – 87.0)</td>
<td>137 (128 – 147)</td>
</tr>
<tr>
<td>60 years and older</td>
<td>81.1 (69.6 – 93.1)</td>
<td>187 (170 – 205)</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 6 years and older</td>
<td>55.5 (41.9 – 59.3)</td>
<td>174 (164 – 185)</td>
</tr>
<tr>
<td>6–11 years</td>
<td>60.2 (49.8 – 65.0)</td>
<td>250 (212 – 295)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>66.6 (55.8 – 74.2)</td>
<td>200 (181 – 222)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>71.1 (60.4 – 81.9)</td>
<td>154 (142 – 167)</td>
</tr>
<tr>
<td>40–59 years</td>
<td>75.6 (64.9 – 87.0)</td>
<td>149 (137 – 163)</td>
</tr>
<tr>
<td>60 years and older</td>
<td>81.1 (69.6 – 93.1)</td>
<td>211 (191 – 233)</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 6 years and older</td>
<td>55.5 (41.9 – 59.3)</td>
<td>140 (133 – 147)</td>
</tr>
<tr>
<td>6–11 years</td>
<td>60.2 (49.8 – 65.0)</td>
<td>195 (176 – 215)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>66.6 (55.8 – 74.2)</td>
<td>160 (137 – 163)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>71.1 (60.4 – 81.9)</td>
<td>118 (107 – 131)</td>
</tr>
<tr>
<td>40–59 years</td>
<td>75.6 (64.9 – 87.0)</td>
<td>127 (116 – 139)</td>
</tr>
<tr>
<td>60 years and older</td>
<td>81.1 (69.6 – 93.1)</td>
<td>169 (151 – 189)</td>
</tr>
</tbody>
</table>

† Estimate is subject to greater uncertainty due to small cell size.

### Table 3.4.a.3. Urinary iodine: Mexican Americans

Geometric mean and selected percentiles of urine concentrations (in ng/mL) for Mexican Americans in the U.S. population aged 6 years and older, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10th</td>
<td>50th</td>
</tr>
<tr>
<td><strong>Males and Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 6 years and older</td>
<td>59.9 (52.3 – 68.3)</td>
<td>173 (161 – 185)</td>
</tr>
<tr>
<td>6–11 years</td>
<td>60.8 (54.8 – 69.8)</td>
<td>223 (196 – 253)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>68.9 (60.9 – 78.1)</td>
<td>174 (155 – 194)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>75.8 (67.5 – 85.8)</td>
<td>169 (153 – 186)</td>
</tr>
<tr>
<td>40–59 years</td>
<td>83.2 (72.6 – 95.1)</td>
<td>151 (124 – 184)</td>
</tr>
<tr>
<td>60 years and older</td>
<td>92.4 (79.6 – 106.3)</td>
<td>175 (148 – 207)</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 6 years and older</td>
<td>61.8 (56.1 – 71.0)</td>
<td>173 (162 – 185)</td>
</tr>
<tr>
<td>6–11 years</td>
<td>62.3 (57.5 – 68.3)</td>
<td>224 (187 – 269)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>67.3 (62.1 – 91.0)</td>
<td>194 (164 – 230)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>75.3 (70.5 – 80.8)</td>
<td>167 (148 – 189)</td>
</tr>
<tr>
<td>40–59 years</td>
<td>83.3 (77.8 – 90.0)</td>
<td>139 (112 – 171)</td>
</tr>
<tr>
<td>60 years and older</td>
<td>91.1 (85.7 – 97.3)</td>
<td>196 (166 – 232)</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 6 years and older</td>
<td>57.0 (45.9 – 67.4)</td>
<td>172 (159 – 187)</td>
</tr>
<tr>
<td>6–11 years</td>
<td>65.2 (56.0 – 75.9)</td>
<td>221 (182 – 269)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>72.4 (63.8 – 82.6)</td>
<td>154 (134 – 178)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>80.0 (69.8 – 91.5)</td>
<td>171 (148 – 198)</td>
</tr>
<tr>
<td>40–59 years</td>
<td>88.0 (79.4 – 97.1)</td>
<td>165 (128 – 212)</td>
</tr>
<tr>
<td>60 years and older</td>
<td>95.5 (87.4 – 104.0)</td>
<td>159 (117 – 218)</td>
</tr>
</tbody>
</table>

† Estimate is subject to greater uncertainty due to small cell size.
### Table 3.4.a.4. Urinary iodine: Non-Hispanic blacks

Geometric mean and selected percentiles of urine concentrations (in ng/mL) for non-Hispanic blacks in the U.S. population aged 6 years and older, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10th</td>
<td>50th</td>
</tr>
<tr>
<td><strong>Males and Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 6 years and older</td>
<td>141 (131 – 151)</td>
<td>141 (128 – 152)</td>
</tr>
<tr>
<td>6–11 years</td>
<td>186 (163 – 213)</td>
<td>190 (168 – 217)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>149 (137 – 163)</td>
<td>148 (138 – 168)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>128 (113 – 145)</td>
<td>125 (116 – 160)</td>
</tr>
<tr>
<td>40–59 years</td>
<td>140 (124 – 160)</td>
<td>134 (122 – 144)</td>
</tr>
<tr>
<td>60 years and older</td>
<td>128 (108 – 151)</td>
<td>128 (102 – 146)</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 6 years and older</td>
<td>158 (145 – 172)</td>
<td>159 (142 – 176)</td>
</tr>
<tr>
<td>6–11 years</td>
<td>208 (172 – 251)</td>
<td>205 (172 – 284)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>161 (145 – 178)</td>
<td>155 (141 – 177)</td>
</tr>
<tr>
<td>40–59 years</td>
<td>161 (134 – 192)</td>
<td>145 (125 – 198)</td>
</tr>
<tr>
<td>60 years and older</td>
<td>145 (105 – 200)</td>
<td>141 (91.6 – 204)</td>
</tr>
<tr>
<td><strong>Total, 6 years and older</strong></td>
<td>127 (117 – 138)</td>
<td>128 (121 – 136)</td>
</tr>
<tr>
<td>6–11 years</td>
<td>166 (145 – 190)</td>
<td>168 (151 – 211)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>139 (124 – 156)</td>
<td>139 (125 – 164)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>118 (98.4 – 142)</td>
<td>123 (105 – 148)</td>
</tr>
<tr>
<td>40–59 years</td>
<td>125 (107 – 147)</td>
<td>122 (103 – 137)</td>
</tr>
<tr>
<td>60 years and older</td>
<td>116 (91.7 – 148)</td>
<td>115 (83.6 – 146)</td>
</tr>
</tbody>
</table>

† Estimate is subject to greater uncertainty due to small cell size.

### Table 3.4.a.5. Urinary iodine: Non-Hispanic whites

Geometric mean and selected percentiles of urine concentrations (in ng/mL) for non-Hispanic whites in the U.S. population aged 6 years and older, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10th</td>
<td>50th</td>
</tr>
<tr>
<td><strong>Males and Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 6 years and older</td>
<td>159 (151 – 168)</td>
<td>166 (156 – 176)</td>
</tr>
<tr>
<td>6–11 years</td>
<td>237 (208 – 271)</td>
<td>267 (202 – 315)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>187 (160 – 218)</td>
<td>194 (172 – 224)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>133 (122 – 145)</td>
<td>139 (125 – 150)</td>
</tr>
<tr>
<td>40–59 years</td>
<td>140 (131 – 151)</td>
<td>153 (139 – 167)</td>
</tr>
<tr>
<td>60 years and older</td>
<td>193 (175 – 214)</td>
<td>193 (172 – 211)</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 6 years and older</td>
<td>182 (170 – 195)</td>
<td>187 (176 – 199)</td>
</tr>
<tr>
<td>6–11 years</td>
<td>292 (230 – 371)</td>
<td>315 (229 – 381)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>213 (185 – 246)</td>
<td>208 (187 – 242)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>159 (141 – 179)</td>
<td>163 (139 – 186)</td>
</tr>
<tr>
<td>40–59 years</td>
<td>153 (140 – 168)</td>
<td>153 (137 – 173)</td>
</tr>
<tr>
<td>60 years and older</td>
<td>220 (198 – 245)</td>
<td>218 (197 – 249)</td>
</tr>
<tr>
<td><strong>Total, 6 years and older</strong></td>
<td>141 (132 – 149)</td>
<td>148 (137 – 157)</td>
</tr>
<tr>
<td>6–11 years</td>
<td>191 (166 – 221)</td>
<td>194 (150 – 251)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>162 (127 – 206)</td>
<td>171 (138 – 227)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>112 (98.2 – 129)</td>
<td>115 (102 – 130)</td>
</tr>
<tr>
<td>40–59 years</td>
<td>129 (117 – 143)</td>
<td>150 (123 – 178)</td>
</tr>
<tr>
<td>60 years and older</td>
<td>174 (153 – 197)</td>
<td>166 (137 – 191)</td>
</tr>
</tbody>
</table>

† Estimate is subject to greater uncertainty due to small cell size.
### Table 3.4.b. Urinary iodine: Concentrations by survey cycle

Geometric mean and selected percentiles of urine concentrations (in ng/mL) for the U.S. population, National Health and Nutrition Examination Survey, 2001–2006.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Gender</th>
<th>Mexican Americans</th>
<th>Race/ethnicity</th>
<th>Non-Hispanic Blacks</th>
<th>Non-Hispanic Whites</th>
</tr>
</thead>
<tbody>
<tr>
<td>12–19 years</td>
<td>Males</td>
<td>Geometric mean</td>
<td>3rd</td>
<td>95th</td>
<td>Gender</td>
</tr>
<tr>
<td>2001–2002</td>
<td>192 (178 – 207)</td>
<td>38.3 (23.5 – 47.2)</td>
<td>205 (189 – 214)</td>
<td>771 (700 – 918)</td>
<td>831</td>
</tr>
<tr>
<td>2003–2004</td>
<td>166 (141 – 195)</td>
<td>33.5 (17.9 – 46.4)</td>
<td>178 (144 – 203)</td>
<td>643 (503 – 924)</td>
<td>721</td>
</tr>
<tr>
<td>6–11 years</td>
<td>Females</td>
<td>Geometric mean</td>
<td>3rd</td>
<td>95th</td>
<td>Gender</td>
</tr>
<tr>
<td>2001–2002</td>
<td>148 (132 – 166)</td>
<td>27.8 (22.0 – 40.6)</td>
<td>153 (136 – 173)</td>
<td>536 (473 – 762)</td>
<td>627</td>
</tr>
<tr>
<td>2003–2004</td>
<td>138 (125 – 151)</td>
<td>23.8 (18.5 – 32.3)</td>
<td>146 (123 – 165)</td>
<td>564 (446 – 746)</td>
<td>517</td>
</tr>
<tr>
<td>20–39 years</td>
<td>Males</td>
<td>Geometric mean</td>
<td>3rd</td>
<td>95th</td>
<td>Gender</td>
</tr>
<tr>
<td>12–19 years</td>
<td>Females</td>
<td>Geometric mean</td>
<td>3rd</td>
<td>95th</td>
<td>Gender</td>
</tr>
<tr>
<td>2001–2002</td>
<td>177 (156 – 200)</td>
<td>40.7 (30.1 – 48.7)</td>
<td>171 (152 – 198)</td>
<td>744 (617 – 1,250)</td>
<td>509</td>
</tr>
<tr>
<td>2003–2004</td>
<td>169 (152 – 189)</td>
<td>39.7 (29.9 – 45.9)</td>
<td>170 (148 – 196)</td>
<td>635 (518 – 776)</td>
<td>539</td>
</tr>
<tr>
<td>2005–2006</td>
<td>205 (175 – 240)</td>
<td>47.9 (35.6 – 59.7)</td>
<td>195 (172 – 223)</td>
<td>826 (620 – 4,220)</td>
<td>474</td>
</tr>
<tr>
<td>40–59 years</td>
<td>Males</td>
<td>Geometric mean</td>
<td>3rd</td>
<td>95th</td>
<td>Gender</td>
</tr>
<tr>
<td>2001–2002</td>
<td>192 (178 – 208)</td>
<td>41.7 (35.0 – 48.0)</td>
<td>196 (179 – 209)</td>
<td>769 (630 – 981)</td>
<td>1,333</td>
</tr>
<tr>
<td>2003–2004</td>
<td>169 (156 – 183)</td>
<td>38.8 (25.9 – 44.3)</td>
<td>178 (164 – 193)</td>
<td>584 (475 – 786)</td>
<td>1,229</td>
</tr>
<tr>
<td>2005–2006</td>
<td>179 (163 – 197)</td>
<td>38.0 (32.9 – 44.8)</td>
<td>182 (172 – 195)</td>
<td>702 (595 – 960)</td>
<td>1,248</td>
</tr>
<tr>
<td>60 years and older</td>
<td>Females</td>
<td>Geometric mean</td>
<td>3rd</td>
<td>95th</td>
<td>Gender</td>
</tr>
<tr>
<td>2003–2004</td>
<td>134 (125 – 145)</td>
<td>25.0 (23.0 – 29.0)</td>
<td>141 (127 – 155)</td>
<td>559 (493 – 584)</td>
<td>1,297</td>
</tr>
<tr>
<td>2005–2006</td>
<td>146 (136 – 158)</td>
<td>31.2 (20.6 – 39.0)</td>
<td>147 (137 – 155)</td>
<td>592 (544 – 693)</td>
<td>1,101</td>
</tr>
</tbody>
</table>

### Note

- Sample sizes may vary due to different survey years and population groups.
- Geometric means and percentiles are presented along with 95% confidence intervals.
- Conversion of iodine concentrations from ng/mL to μg/L can be done using the factor 33.8646.

*Source: National Health and Nutrition Examination Survey (NHANES)*
Figure 3.4.b. Urinary iodine: Concentrations by survey cycle
Selected percentiles in ng/mL (95% confidence intervals), National Health and Nutrition Examination Survey, 2001–2006

3. Trace Elements
Table 3.5.a.1. Urinary iodine (creatinine corrected): Concentrations

Geometric mean and selected percentiles of urine concentrations (in µg/g creatinine) for the total U.S. population aged 6 years and older, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Geometric mean (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Selected percentiles (95% conf. interval)</strong></td>
<td>2.5th</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td><strong>Total, 6 years and older</strong></td>
<td>155 (147 – 163)</td>
</tr>
<tr>
<td><strong>Age group</strong></td>
<td></td>
</tr>
<tr>
<td>6–11 years</td>
<td>269 (244 – 297)</td>
</tr>
<tr>
<td>12–19 years</td>
<td>134 (124 – 145)</td>
</tr>
<tr>
<td>20–39 years</td>
<td>119 (111 – 127)</td>
</tr>
<tr>
<td>40–59 years</td>
<td>145 (136 – 156)</td>
</tr>
<tr>
<td>60 years and older</td>
<td>224 (209 – 241)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
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</tr>
<tr>
<td>Males</td>
<td>145 (137 – 153)</td>
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<tr>
<td>Females</td>
<td>165 (156 – 174)</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong></td>
<td></td>
</tr>
<tr>
<td>Mexican Americans</td>
<td>160 (151 – 170)</td>
</tr>
<tr>
<td>Non-Hispanic Blacks</td>
<td>98.6 (91.2 – 106)</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td>167 (161 – 174)</td>
</tr>
</tbody>
</table>
Figure 3.5.a. Urinary iodine (creatinine corrected): Concentrations by age group
Geometric mean (95% confidence interval), National Health and Nutrition Examination Survey, 2003–2006
Table 3.5.a.2. Urinary iodine (creatinine corrected): Total population
Geometric mean and selected percentiles of urine concentrations (in µg/g creatinine) for the total U.S. population aged 6 years and older, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10th</td>
<td>50th</td>
</tr>
<tr>
<td><strong>Males and Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 6 years and older</td>
<td>155</td>
<td>149</td>
</tr>
<tr>
<td>6–11 years</td>
<td>269</td>
<td>266</td>
</tr>
<tr>
<td>12–19 years</td>
<td>134</td>
<td>125</td>
</tr>
<tr>
<td>20–39 years</td>
<td>119</td>
<td>111</td>
</tr>
<tr>
<td>40–59 years</td>
<td>145</td>
<td>146</td>
</tr>
<tr>
<td>60 years and older</td>
<td>224</td>
<td>214</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 6 years and older</td>
<td>145</td>
<td>138</td>
</tr>
<tr>
<td>6–11 years</td>
<td>283</td>
<td>280</td>
</tr>
<tr>
<td>12–19 years</td>
<td>134</td>
<td>132</td>
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<td>20–39 years</td>
<td>114</td>
<td>103</td>
</tr>
<tr>
<td>40–59 years</td>
<td>129</td>
<td>126</td>
</tr>
<tr>
<td>60 years and older</td>
<td>198</td>
<td>180</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 6 years and older</td>
<td>165</td>
<td>157</td>
</tr>
<tr>
<td>6–11 years</td>
<td>256</td>
<td>247</td>
</tr>
<tr>
<td>12–19 years</td>
<td>134</td>
<td>121</td>
</tr>
<tr>
<td>20–39 years</td>
<td>123</td>
<td>118</td>
</tr>
<tr>
<td>40–59 years</td>
<td>162</td>
<td>166</td>
</tr>
<tr>
<td>60 years and older</td>
<td>247</td>
<td>243</td>
</tr>
</tbody>
</table>

† Estimate is subject to greater uncertainty due to small cell size.

Table 3.5.a.3. Urinary iodine (creatinine corrected): Mexican Americans
Geometric mean and selected percentiles of urine concentrations (in µg/g creatinine) for Mexican Americans in the U.S. population aged 6 years and older, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10th</td>
<td>50th</td>
</tr>
<tr>
<td><strong>Males and Females</strong></td>
<td></td>
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</tr>
<tr>
<td>Total, 6 years and older</td>
<td>160</td>
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<td>143</td>
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<td>20–39 years</td>
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<tr>
<td>40–59 years</td>
<td>146</td>
<td>148</td>
</tr>
<tr>
<td>60 years and older</td>
<td>222</td>
<td>210</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 6 years and older</td>
<td>148</td>
<td>147</td>
</tr>
<tr>
<td>6–11 years</td>
<td>269</td>
<td>278</td>
</tr>
<tr>
<td>12–19 years</td>
<td>147</td>
<td>141</td>
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<tr>
<td>20–39 years</td>
<td>124</td>
<td>121</td>
</tr>
<tr>
<td>40–59 years</td>
<td>133</td>
<td>136</td>
</tr>
<tr>
<td>60 years and older</td>
<td>189</td>
<td>168</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, 6 years and older</td>
<td>174</td>
<td>174</td>
</tr>
<tr>
<td>6–11 years</td>
<td>284</td>
<td>250</td>
</tr>
<tr>
<td>12–19 years</td>
<td>145</td>
<td>144</td>
</tr>
<tr>
<td>20–39 years</td>
<td>153</td>
<td>143</td>
</tr>
<tr>
<td>40–59 years</td>
<td>160</td>
<td>160</td>
</tr>
<tr>
<td>60 years and older</td>
<td>253</td>
<td>232</td>
</tr>
</tbody>
</table>
Table 3.5.a.4. Urinary iodine (creatinine corrected): Non-Hispanic blacks
Geometric mean and selected percentiles of urine concentrations (in µg/g creatinine) for non-Hispanic blacks in the U.S. population aged 6 years and older, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Males and Females</th>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total, 6 years and older</td>
<td>98.6 (91.2 – 106)</td>
<td>39.0 (35.8 – 41.7) 90.4 (83.4 – 99.1) 264 (248 – 293)</td>
<td>1,363</td>
</tr>
<tr>
<td>6–11 years</td>
<td>188 (164 – 214)</td>
<td>80.2 (67.6 – 87.6) 180 (152 – 221) 448 (376 – 558)</td>
<td>221</td>
</tr>
<tr>
<td>12–19 years</td>
<td>90.8 (83.6 – 98.6)</td>
<td>40.5 (36.5 – 42.5) 87.0 (78.8 – 95.5) 223 (191 – 258)</td>
<td>315</td>
</tr>
<tr>
<td>20–39 years</td>
<td>75.5 (67.9 – 83.9)</td>
<td>35.6 (31.1 – 38.6) 72.6 (63.6 – 80.4) 209 (137 – 254)</td>
<td>238</td>
</tr>
<tr>
<td>40–59 years</td>
<td>98.3 (88.0 – 110)</td>
<td>38.1 (32.9 – 45.4) 90.5 (78.2 – 103) 257 (217 – 296)</td>
<td>219</td>
</tr>
<tr>
<td>60 years and older</td>
<td>123 (106 – 143)</td>
<td>46.0 (40.3 – 50.9) 108 (98.4 – 129) 337 (251 – 498)</td>
<td>170</td>
</tr>
</tbody>
</table>

Table 3.5.a.5. Urinary iodine (creatinine corrected): Non-Hispanic whites
Geometric mean and selected percentiles of urine concentrations (in µg/g creatinine) for non-Hispanic whites in the U.S. population aged 6 years and older, National Health and Nutrition Examination Survey, 2003–2006.

<table>
<thead>
<tr>
<th>Males and Females</th>
<th>Geometric mean (95% conf. interval)</th>
<th>Selected percentiles (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total, 6 years and older</td>
<td>96.5 (89.3 – 104)</td>
<td>39.3 (35.7 – 44.7) 89.3 (84.3 – 97.6) 247 (218 – 285)</td>
<td>700</td>
</tr>
<tr>
<td>6–11 years</td>
<td>188 (167 – 211)</td>
<td>83.8 (68.1 – 98.7) 185 (152 – 220) 442 (375 – 548)</td>
<td>115</td>
</tr>
<tr>
<td>12–19 years</td>
<td>91.5 (82.1 – 102)</td>
<td>42.8 (36.5 – 46.2) 88.5 (76.0 – 99.7) 205 (164 – 311)</td>
<td>255</td>
</tr>
<tr>
<td>20–39 years</td>
<td>74.9 (64.2 – 87.5)</td>
<td>36.1 (30.0 – 39.1) 72.7 (60.5 – 84.3) 196 (130 – 248)</td>
<td>130</td>
</tr>
<tr>
<td>40–59 years</td>
<td>92.9 (83.6 – 103)</td>
<td>39.5 (29.3 – 47.1) 88.5 (73.7 – 99.0) 217 (196 – 284)</td>
<td>115</td>
</tr>
<tr>
<td>60 years and older</td>
<td>123 (99.9 – 152)</td>
<td>50.2 (30.9 – 61.9) 111 (97.1 – 134) 255† (229 – 540)</td>
<td>85</td>
</tr>
</tbody>
</table>

† Estimate is subject to greater uncertainty due to small cell size.
Table 3.5.b. Urinary iodine (creatinine corrected): Concentrations by survey cycle

<table>
<thead>
<tr>
<th>Age group</th>
<th>Sample size</th>
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<th>95th</th>
<th>95% conf. interval</th>
<th>95% conf. interval</th>
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<td>6–11 years</td>
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</tr>
<tr>
<td>2001–2002</td>
<td>273 (246–304)</td>
<td>94.5</td>
<td>257</td>
<td>220–319</td>
<td>923 (772–1,140)</td>
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<tr>
<td>2003–2004</td>
<td>254 (228–283)</td>
<td>84.4</td>
<td>246</td>
<td>233–269</td>
<td>718 (615–1,210)</td>
</tr>
<tr>
<td>12–19 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001–2002</td>
<td>149 (137–161)</td>
<td>52.5</td>
<td>138</td>
<td>129–146</td>
<td>601 (450–721)</td>
</tr>
<tr>
<td>20–39 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005–2006</td>
<td>123 (112–135)</td>
<td>43.9</td>
<td>114</td>
<td>97.7–131</td>
<td>378 (339–592)</td>
</tr>
<tr>
<td>40–59 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2001–2002</td>
<td>151 (130–175)</td>
<td>44.7</td>
<td>142</td>
<td>120–176</td>
<td>522 (427–712)</td>
</tr>
<tr>
<td>2003–2004</td>
<td>138 (126–152)</td>
<td>42.0</td>
<td>136</td>
<td>126–150</td>
<td>436 (392–561)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>152 (137–170)</td>
<td>47.0</td>
<td>153</td>
<td>126–179</td>
<td>492 (429–544)</td>
</tr>
<tr>
<td>60 years and older</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001–2002</td>
<td>216 (192–244)</td>
<td>67.1</td>
<td>199</td>
<td>179–230</td>
<td>751 (632–1,000)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>246 (218–277)</td>
<td>68.4</td>
<td>235</td>
<td>193–256</td>
<td>858 (697–5,190)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Males</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001–2002</td>
<td>156 (143–171)</td>
<td>47.0</td>
<td>145</td>
<td>137–160</td>
<td>578 (514–674)</td>
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<tr>
<td>2005–2006</td>
<td>152 (140–165)</td>
<td>47.8</td>
<td>147</td>
<td>132–158</td>
<td>540 (480–795)</td>
</tr>
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<td>Females</td>
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<tr>
<td>2003–2004</td>
<td>155 (142–169)</td>
<td>46.9</td>
<td>151</td>
<td>133–167</td>
<td>532 (452–630)</td>
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<tr>
<td>Race/ethnicity</td>
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</tr>
<tr>
<td>2001–2002</td>
<td>164 (152–176)</td>
<td>56.0</td>
<td>154</td>
<td>140–177</td>
<td>589 (469–754)</td>
</tr>
<tr>
<td>2003–2004</td>
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<td>147</td>
<td>133–164</td>
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</tr>
<tr>
<td>2001–2002</td>
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<td>103</td>
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<td>440 (361–645)</td>
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<td>33.1</td>
<td>84.6</td>
<td>73.1–97.6</td>
<td>336 (296–375)</td>
</tr>
<tr>
<td>2005–2006</td>
<td>105 (96.7–115)</td>
<td>33.7</td>
<td>96.6</td>
<td>87.0–111</td>
<td>397 (315–513)</td>
</tr>
<tr>
<td>Non-Hispanic Whites</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005–2006</td>
<td>177 (166–188)</td>
<td>55.0</td>
<td>168</td>
<td>152–179</td>
<td>656 (561–868)</td>
</tr>
</tbody>
</table>
Figure 3.5.b. Urinary iodine (creatinine corrected): Concentrations by survey cycle
Selected percentiles in μg/g creatinine (95% confidence intervals),
References


