Blood Cadmium

Cadmium is a metal that is usually found in nature combined with oxygen, chlorine, or sulfur. Cadmium enters the environment from the weathering of rocks and minerals that contain cadmium. Exposure to cadmium can occur in occupations such as mining or electroplating, where cadmium is produced or used. The general population may be exposed from smoking, breathing cigarette smoke, or eating contaminated foods (ATSDR, 2008; CDC, 2009).

Cadmium and its compounds are toxic to humans and animals and are classified as "Group 1" human carcinogens by the International Agency for Research on Cancer (IARC) (WHO, 1993). Once absorbed into the human body, cadmium can accumulate in the kidneys and remain in the body for decades. Chronic exposure to cadmium can result in serious kidney damage. Osteomalacia, a bone disorder similar to rickets, is also associated with long-term ingestion of cadmium. Acute airborne exposure, as occurs from welding on cadmium-alloy metals, can result in swelling (edema) and scarring (fibrosis) of the lungs (CDC, 2009).

This indicator reflects blood cadmium concentrations in micrograms per liter (µg/L) for the U.S. population, age 1 year and older, as measured in the 1999-2010 continuous National Health and Nutrition Examination Survey (NHANES). NHANES is a series of surveys conducted by the Centers for Disease Control and Prevention's (CDC's) National Center for Health Statistics that is designed to collect data on the health and nutritional status of the civilian, non-institutionalized U.S. population using a complex, stratified, multistage, probability-cluster design. CDC's National Center for Environmental Health conducted the laboratory analyses for the biomonitoring samples. Beginning in 1999, NHANES became a continuous and annual national survey; biomonitoring for certain environmental chemicals also was implemented. The data presented here cover six different survey periods: 1999-2000, 2001-2002, 2003-2004, 2005-2006, 2007-2008, and 2009-2010.

What the Data Show

Between 1999 and 2010, the calculated geometric mean blood cadmium levels among total NHANES participants age 1 year and older ranged from 0.302 µg/L (2003-2004 and 2009-2010) to 0.412 µg/L (1999-2000) (Exhibit 1). Overall, there is not much variation in the geometric means across the different time periods or across different race/ethnicity subgroups. The blood cadmium measurements were similar among males and females across time periods (Exhibit 1). For the race and ethnicity subgroups, the lowest blood cadmium level at each reported percentile across all the survey periods was observed in Mexican Americans (Exhibit 2).

The geometric mean blood cadmium level was not calculated for several subgroups because of the high number of samples that were below the analytical method's limit of detection. This is most obvious for the age group analysis, where the proportion of samples above the limit of detection for the groups below 20 years of age was not sufficient to provide valid geometric means except in the 12-19 years age group for one survey period (1999-2000) (Exhibit 3). The highest blood cadmium levels are seen in the group 20 years and older, with geometric means of 0.358 µg/L (2009-2010) to 0.468 µg/L (1999-2000). The 95 th percentiles of blood cadmium levels for the 20 years and older age group ranged from 1.5 µg/L (1999-2000) to 1.8 µg/L (2003-2004) (Exhibit 3).

Limitations

- The relatively small number of samples collected in a two-year cycle (e.g., 1999-2000 or 2001-2002) may, in some cases, result in measures of central tendency that are unstable from one survey period to the next.

- Health-based benchmarks for blood levels of cadmium have not been established.

Data Sources

Data used for this indicator were generated with Stata statistical software utilizing the NHANES laboratory files available online in SAS® transport file format (CDC, 2012).

References

ATSDR (Agency for Toxic Substances and Disease Registry). 2008. Cadmium fact sheet. Division of Toxicology and Environmental Medicine ToxFAQs. http://www.atsdr.cdc.gov/tfacts5.pdf (PDF) (2pp, 57K).

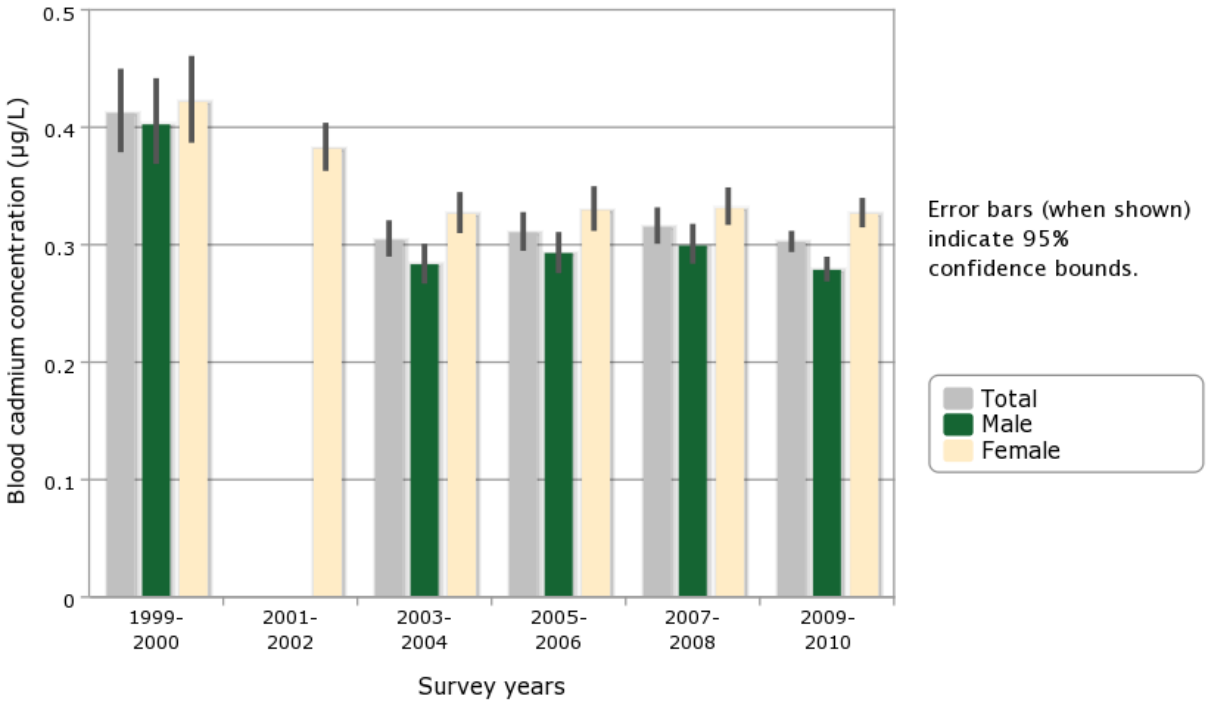
CDC (Centers for Disease Control and Prevention). 2012. National Center for Health Statistics, National Health and Nutrition Examination Survey. Lab 06 nutritional biochemistries (1999-2000); Lab 06 nutritional biochemistries (2001-2002); Blood lead and blood cadmium (2003-2004); Blood lead and blood cadmium (2005-2006); Blood cadmium and lead (2007-2008); Blood cadmium and lead (2009-2010). Accessed September 2012. http://www.cdc.gov/nchs/nhanes/nhanes_questionnaires.htm.

CDC. 2009. Fourth national report on human exposure to environmental chemicals. http://www.cdc.gov/exposurereport.

WHO (World Health Organization). 1993. International Agency for Research on Cancer monographs on the evaluation of carcinogenic risks to humans: beryllium, cadmium, mercury, and exposures in the glass manufacturing industry. Volume 58. http://monographs.iarc.fr/ENG/Monographs/vol58/index.php.

Exhibit 1. Blood cadmium concentrations for the U.S. population age 1 year and older by sex, 1999-2010

Geometric mean



Geometric means are not calculated in cases where the proportion of results below the limit of detection was too high to provide a valid result. The limit of detection for cadmium was 0.3 µg/L in 1999–2000 and 2001–2002; 0.14 µg/L in 2003–2004; and 0.2 µg/L in 2005–2010.

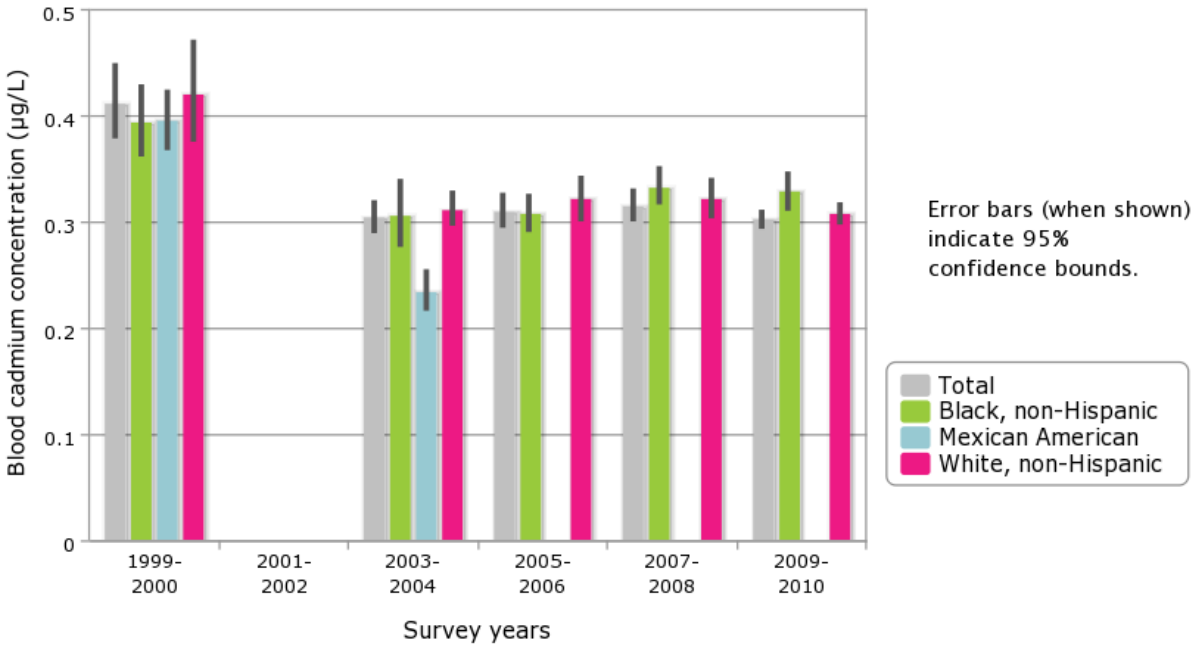
Information on the statistical significance of the trends in this exhibit is not presented here. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: CDC, 2012

Visit http://www.epa.gov/roe to see the full exhibit.

Exhibit 2. Blood cadmium concentrations for the U.S. population age 1 year and older by race and ethnicity, 1999-2010

Geometric mean



Geometric means are not calculated in cases where the proportion of results below the limit of detection was too high to provide a valid result. The limit of detection for cadmium was 0.3 µg/L in 1999–2000 and 2001–2002; 0.14 µg/L in 2003–2004; and 0.2 µg/L in 2005–2010.

Other racial and ethnic groups are included in the "total" only.

Information on the statistical significance of the trends in this exhibit is not presented here. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: CDC, 2012

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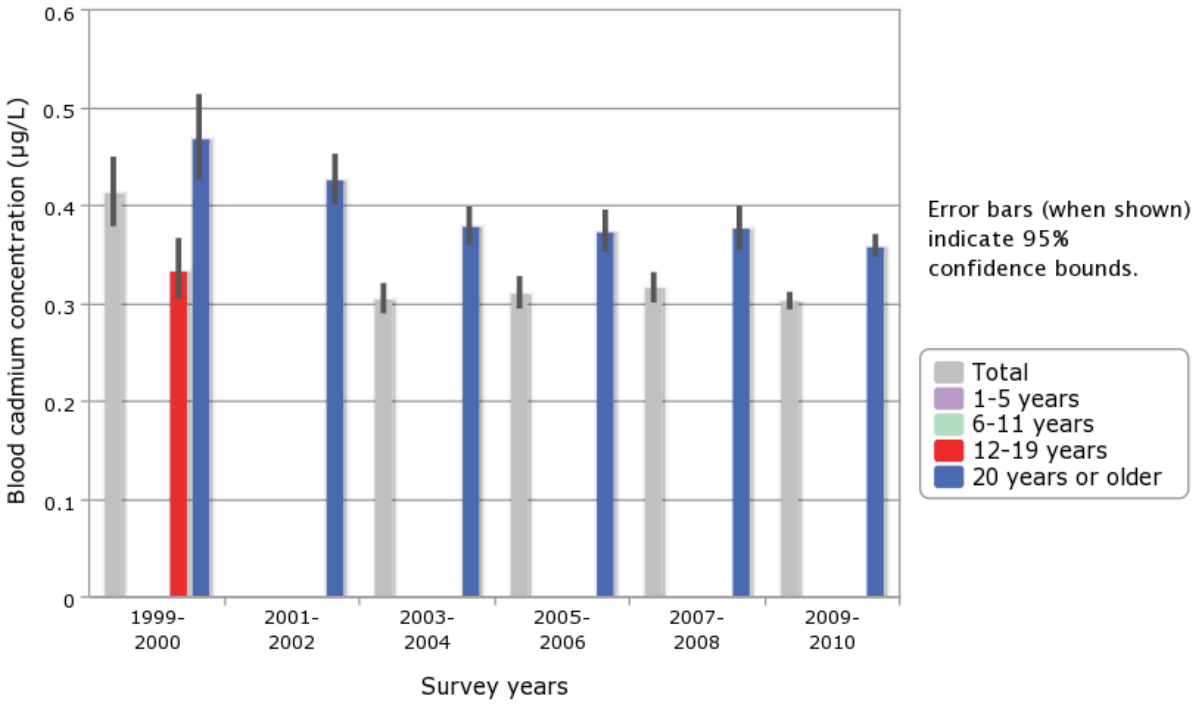
Exhibit 3. Blood cadmium concentrations for the U.S. population age 1 year and older by age group, 1999-2010

Geometric mean



Geometric means are not calculated in cases where the proportion of results below the limit of detection was too high to provide a valid result. The limit of detection for cadmium was 0.3 µg/L in 1999–2000 and 2001–2002; 0.14 µg/L in 2003–2004; and 0.2 µg/L in 2005–2010.

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