

LEAD UPDATE

Summary of findings from the ABLES Program for 2009

Adult Blood Lead Epidemiology and Surveillance, N.C. Division of Public Health

More information about ABLES is located at: <http://epi.publichealth.nc.gov/oii/ables.html>

Summary

In 2009, the North Carolina Adult Blood Lead Epidemiology and Surveillance (ABLES) Program received 5,633 blood lead reports from 5,332 individuals age 16 years and older. Of these, 392 (7%) persons had blood lead concentrations that were considered elevated (≥ 10 $\mu\text{g/dL}$). Of the elevated blood lead levels (EBLLs), only 142 (3%) were ≥ 25 $\mu\text{g/dL}$. When comparing 2009 to the previous four years, the reported number of blood lead levels (BLLs) were lower than in previous years, although the number of individuals with BLLs ≥ 25 $\mu\text{g/dL}$ did not significantly decrease substantially over this five-year interval. In North Carolina, EBLLs attributed to occupational exposures were more than 10 times greater than EBLLs attributed to non-occupational exposures. Of those lead exposures associated with a specific occupation, primary battery manufacturing was most frequently associated with EBLLs. Overall, data suggest rates of EBLL appear to be decreasing in North Carolina over the past three years.

Background

Lead exposure can result in acute or chronic adverse health effects in multiple organ systems ranging from mild symptoms to serious, life-threatening toxicity. Adults are primarily exposed in the workplace (95%). Adults can also experience exposure in the home and community through activities such as home remodeling, lead-contaminated consumer products, traditional medicinal remedies, moonshine whiskey and hobbies. Adult lead exposures can likewise lead to secondary child exposures through contamination of the home environment from lead residues on cloths, skin and shoes. The public health goal for preventing elevated adult blood lead is to keep the BLL below 10 $\mu\text{g/dL}$, which is consistent with the objective outlined in Healthy People 2020 (1). The North Carolina Adult Blood Lead Epidemiology and Surveillance (ABLES) program was established in 1994 to monitor and respond to EBLLs in adults. The goal of the program is to determine the frequency of EBLLs in adults, identify groups commonly exposed, determine reasons for exposure and make prevention recommendations. A mandatory reporting requirement in North Carolina is in place that requires laboratories to report adult blood lead levels (10 A NCAC 41C .0701 - .0703).

Methods

Components of the surveillance system were developed by the national ABLES Program at the Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health (NIOSH). NIOSH, in partnership with state health departments, develops case definitions, required data collection elements, suggested follow-up activities, and annual data sharing requirements. Most BLLs are reported from laboratories via mail, fax and electronically. Results are manually entered into a Microsoft Access database. Descriptive statistics (frequencies) were done for select variables using SAS. Tables and bar graphs were created using Excel.

Results

In 2009, 5,633 blood lead reports were processed for 5,332 individuals age 16 years and older. The mean BLL was 4.1 µg/dL and the median was 3.0 µg/dL (range: 1.0 – 57.0 µg/dL). Ninety-three percent of persons with blood lead reports had BLLs that were below 10 µg/dL, and 392 (7%) individuals had EBLs ≥ 10 µg/dL. Specifically, 250 of 392 (64%) persons with EBLs had a blood lead concentration between 10 µg/dL and 24 µg/dL, and 142 (36%) persons had an EBL ≥ 25 µg/dL. There were only 14 persons with EBLs ≥ 40 µg/dL, and no reports ≥ 60 µg/dL (Table 1).

In 2009, the number of reported BLLs dropped to its lowest point since 2005, a 17 percent decrease (Figure 1). For individuals with an EBL of ≥10 µg/dL, prevalence and incidence rates were lower than in preceding years. Based on blood lead reports in the ABLES database, the prevalence of EBLs ≥ 10 µg/dL per 100,000 employed persons decreased from 10.9 to 9.6 cases between 2005 and 2009. In addition, the incidence rate per 100,000 employed persons dropped from 8.4 cases in 2005 to 6.9 cases in 2009 (Figure 2). The prevalence and incidence rates of individuals with BLLs ≥ 25 µg/dL remained relatively stable between 2005 and 2009. In 2005, the prevalence and incidence of EBLs ≥ 25 µg/dL was 3.2 and 2.3 cases per 100,000 employed persons, respectively. In 2009, the prevalence rate of EBLs ≥ 25 µg/dL was 3.5 cases per 100,000 employed persons and the incidence rate was 2.1 cases per 100,000 employed persons (Figure 3).

For reports where demographic information was available (3,203 persons), most of the individuals tested for blood lead were male (60%). Males accounted for 94 percent of EBLs; and while females accounted for 40 percent of the adults tested for blood lead, only 6 percent were elevated. Most EBL cases were between 25 and 54 years of age (mean = 42.4 years; median = 40.0 years) (Table 2). For reports where exposure sources were identified (146 reports), most persons with EBLs (93%) were associated with an occupational source (Table 1). In 2009, the industry with the greatest percentage of EBL reports was primary battery manufacturing (79%), followed by inorganic chemical manufacturing (9%), and storage battery manufacturing (7%) (Table 3). Specific exposure source information was not available for individuals with non-occupational exposures.

Conclusions

Most individuals tracked by ABLES in North Carolina have normal BLLs. Importantly, rates of EBLs in adults are decreasing in North Carolina. In 2009, the prevalence rate of 3.5 per 100,000 persons with EBLs ≥ 25 µg/dL was well below the national rate of 6.3 per 100,000 persons (5). While surveillance demonstrates that females are tested for blood lead almost as frequently as males – males have significantly more EBLs. Battery manufacturing was associated with the largest proportion of EBLs; which is consistent with national ABLES data (5). More information is needed about non-occupational sources of exposure, which account for approximately 7% of EBL reports.

ABLES is critical for recommending intervention. Based on the 2009 surveillance data, outreach should continue to focus on battery and inorganic chemical manufacturing industries. NC DPH continues to partner with the NC Department of Labor (NCDOL) by supporting consultation and regulatory enforcement. De-identified data from ABLES and notices of problem industries are shared with NCDOL on a quarterly basis.

NC ABLES data indicate there are a substantial number of women in the workplace that are being exposed to lead requiring testing. Pregnant and lactating women with BLL of 5 µg/dL or greater are considered at high risk for adverse birth outcomes and should be counseled on the dangers of lead exposure (6). In addition, CDC recommends counseling all females of childbearing age who might become pregnant on the dangers of lead poisoning (7). The ABLES program worked with the Lead Ad Hoc Advisory Group and Healthy Homes Outreach Task Force in early 2011 to produce a brochure for pregnant women on the dangers of lead exposure at home and at work. The brochure described will be used to raise awareness of working women of childbearing age.

Limitations

This report is subject to at least two limitations. The number of adults with EBLLs reported to ABLES may represent underreporting because some employers might not provide BLL testing to all lead-exposed workers as required by OSHA regulations and because some laboratories might not report all tests as required by state regulations. Another limitation is lack of case follow-up leading to lack of descriptive data for most EBLLs. The program does not receive demographic and work-related data associated with BLLs on a consistent basis from clinics and labs. Also for years up to 2009 follow-up was restricted to occupational cases with BLL \geq 25 µg/dL. Follow-up criteria have been expanded to include levels between 10 – 24 µg/dL and more resources are being devoted to obtaining case detail for both occupational and non-occupational cases.

Tables and Figures

Table 1. Distribution of Highest Blood Lead Levels (BLLs) Among Adults Tested for Blood Lead in North Carolina: 2009

BLL ($\mu\text{g/dL}$)*	Exposure Source							
	All		Occupational		Non-occupational		Unknown	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
<10	4940	92.6%	28	20.6%	0	0.0%	4912	94.7%
10-24	250	4.7%	11	8.1%	1	10.0%	238	4.6%
25-39	128	2.4%	87	64.0%	8	80.0%	33	0.6%
40-49	13	0.2%	10	7.4%	1	10.0%	2	0.0%
50-59	1	0.0%	0	0.0%	0	0.0%	1	0.0%
≥ 60	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	5,332	100.0%	136	100.0%	10	100.0%	5,186	100.0%

BLLs were missing for 4 individuals.

Table 2. Distribution of Gender and Age among Adults Tested for Blood Lead in North Carolina: 2009

Characteristic	BLL ($\mu\text{g/dL}$)					
	All		≥ 10		≥ 25	
	Number	Percent	Number	Percent	Number	Percent
Sex*						
Male	3,203	60.3%	365	93.6%	133	93.7%
Female	2,110	39.7%	25	6.4%	9	6.3%
Total	5,313	100.0%	390	100.0%	142	100.0%
Age (Years)[†]						
16-17	70	1.3%	1	0.3%	0	0.0%
18-24	795	14.9%	22	5.6%	4	2.8%
25-34	1,244	23.3%	80	20.4%	22	15.5%
35-44	938	17.6%	104	26.5%	44	31.0%
45-54	1,000	18.8%	103	26.3%	44	31.0%
55-64	703	13.2%	63	16.1%	23	16.2%
65+	586	11.0%	19	4.8%	5	3.5%
Total	5,332	100.0%	392	100.0%	142	100.0%

*Sex was unknown for 23 individuals.

[†]Age was unknown for 4 individuals.

Table 3. Distribution of Industry among Adults Tested for Blood Lead in North Carolina: 2009

Industry Code* †	Industry Title	BLL (µg/dL)					
		All		≥ 10		≥ 25	
		Number	Percent	Number	Percent	Number	Percent
237310	Highway, Street, and Bridge Construction	2	1.6%	1	0.8%	1	1.0%
238320	Painting and Wall Covering Contractors	1	0.8%	1	0.8%	1	1.0%
325188	All Other Basic Inorganic Chemical Manufacturing	14	11.0%	12	9.8%	9	9.0%
327212	Other Pressed and Blown Glass Manufacturing	1	0.8%	1	0.8%	1	1.0%
331111	Iron and Steel Milling	1	0.8%	1	0.8%	1	1.0%
332999	Miscellaneous Fabricated Metal Product Manufacturing	1	0.8%	1	0.8%	1	1.0%
335911	Storage Battery Manufacturing	8	6.3%	8	6.6%	4	4.0%
335912	Primary Battery Manufacturing	97	76.4%	96	78.7%	82	82.0%
811111	General Automotive Repair	1	0.8%	1	0.8%	0	0.0%
811118	Other Automotive Mechanical and Electrical Repair and Maintenance	1	0.8%	0	0.0%	0	0.0%
Total		127	100.0%	122	100.0%	100	100.0%

* Industry was unknown for 5,205 individuals.

† Industry categorized based on US Bureau of Labor Statistics, 2002. North American Classification System (NAICS).²

Figure 1. Number of Adults Tested for Blood Lead in North Carolina and EBLs: 2005-2009

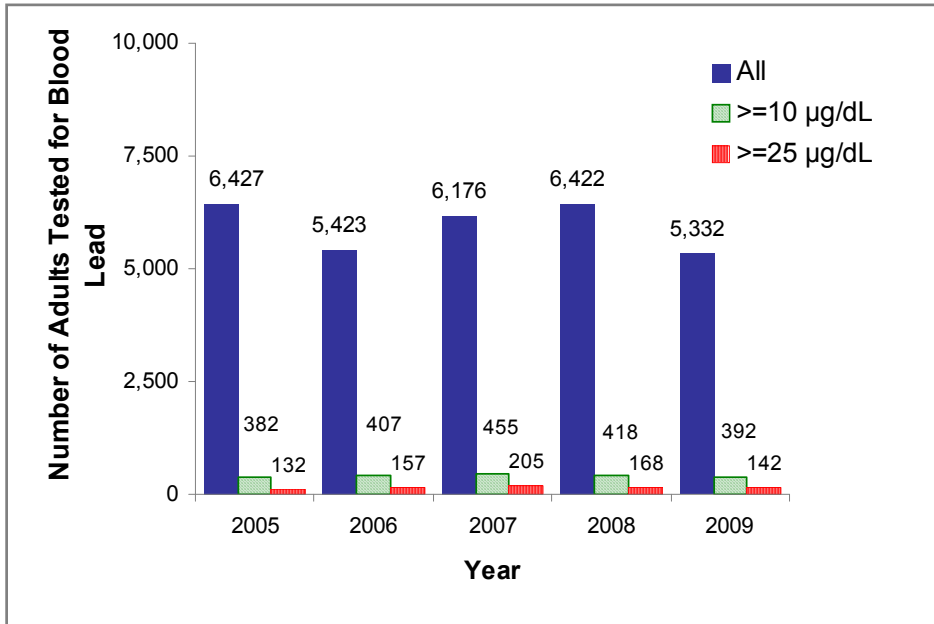
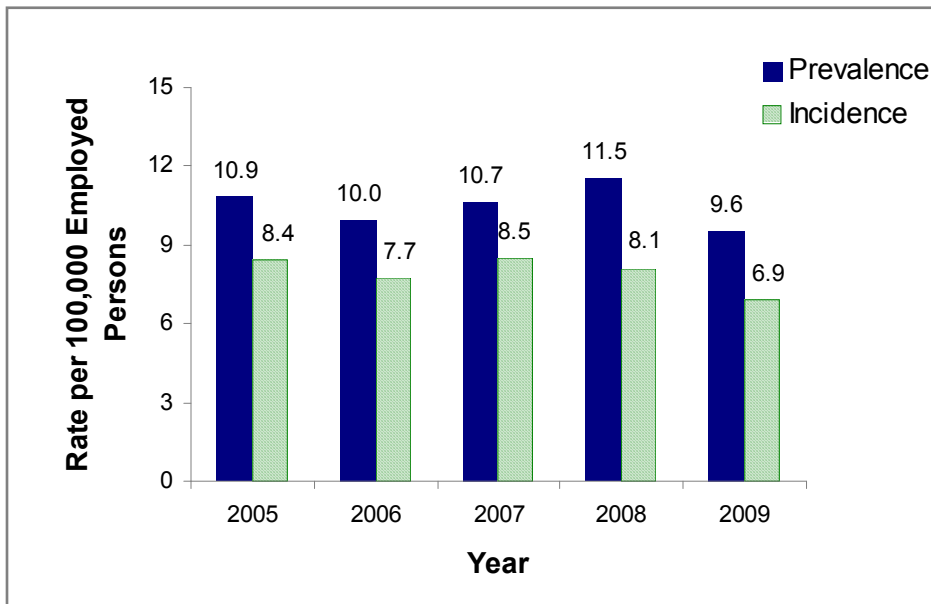
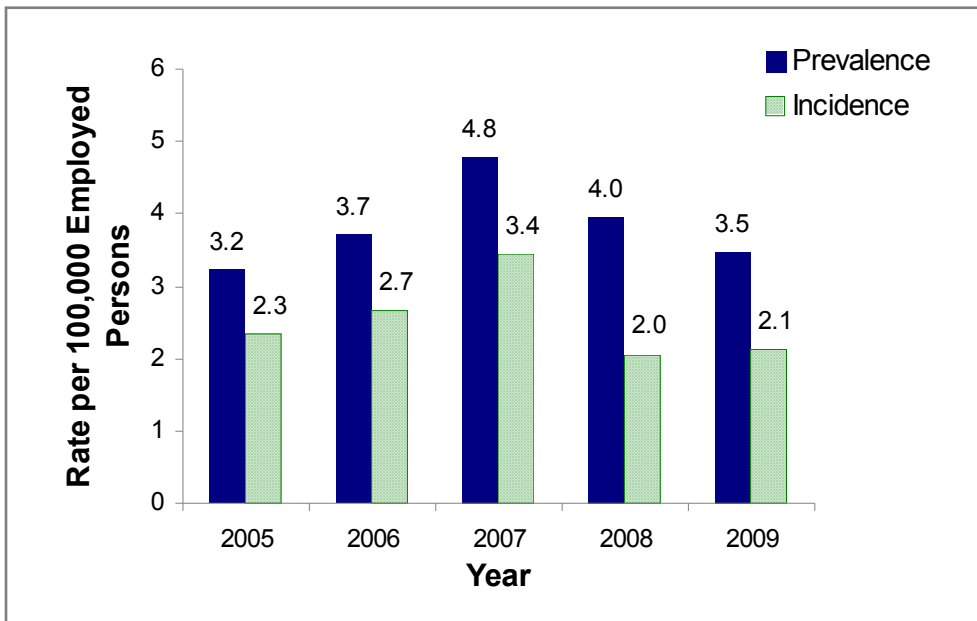


Figure 2. Prevalence and Incidence* of North Carolina Adults with Blood Lead Levels of ≥ 10 µg/dL per 100,000 Employed Persons: 2005-2009



*Employment data provided by the U.S. Bureau of Labor Statistics³.

Figure 3. Prevalence and Incidence of North Carolina Adults with Blood Lead Levels of ≥ 25 $\mu\text{g/dL}$ per 100,000 Employed Persons



Definitions and Technical Notes

ABLES: Adult Blood Lead Epidemiology and Surveillance.

Adult: Residents age 16 years or older.

BLL: Blood lead level.

EBLL: Elevated blood lead level. In 2009, ABLES lowered its case definition for an EBLL from a BLL ≥ 25 $\mu\text{g/dL}$ to a BLL ≥ 10 $\mu\text{g/dL}$.

Incidence: Measures the frequency of new cases of a disease or condition.

Formula: (Annual number of adult residents with a BLL ≥ 10 $\mu\text{g/dL}$ reported in the calendar year, but not reported in the immediately preceding year / annual number of employed adults) x 100,000.⁴

Incident BLL: For individuals with more than one BLL reported for 2008, only the highest BLL was used for analysis. All analyses in the report use incident BLLs.

Employment Data: Annual employment data were collected from the *Geographic Profile of Employment and Unemployment* for the years 2005-2008. The numbers originated from the Current Population Survey (CPS); a nationwide survey of 60,000 households conducted by the United States Bureau of Labor Statistics (BLS).

Prevalence: Measures the frequency of an existing disease or condition.

Formula: (Annual number of adult residents with a BLL ≥ 10 $\mu\text{g/dL}$ / annual number of employed adults) x 100,000.⁴

Rates: All rates are per 100,000 North Carolina employed persons. Rates are not adjusted for age.

References

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