LEAD UPDATE

Summary of findings from the ABLES Program for 2011

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

During 2011, the North Carolina Adult Blood Lead Epidemiology and Surveillance (ABLES) Program received 4,891 blood lead laboratory reports from 4,448 individuals. Of these individuals, 395 (8.9%) had an elevated blood lead level (EBLL), defined as a blood lead level (BLL) ≥ 10 µg/dL, and 147 (3.3%) had a blood lead level ≥ 25 µg/dL, a threshold used by OSHA for their Lead Special Emphasis Program. The total number of BLL laboratory reports received by NC DPH has decreased since 2005, however, no significant trends were observed for EBLL. Among reports with an identified exposure source, occupational exposures were most common (90%). Specifically, primary battery manufacturing was the occupational group with the highest number of EBLL reports. Use of complementary and alternative medicines was the activity most associated with non-occupational lead exposure.

Background

Lead is used in many industries including construction, mining, and manufacturing. The Occupational Safety and Health Administration (OSHA) regulates lead exposure in the workplace to include biomonitoring of workers. Specific standards have been established for general industry, construction and shipyard workers (1). Adults can also experience lead exposure in the home and community through activities such as home remodeling, use of lead-contaminated consumer products and traditional or alternative medicinal remedies, drinking moonshine whiskey and hobbies such as melting lead sinkers or target shooting (2). Adult lead exposures can lead to secondary child exposures through contamination of the home environment from lead residues on clothes, skin and shoes. Lead exposure typically occurs through inhalation or ingestion and can result in acute or chronic adverse health effects in multiple organ systems ranging from mild symptoms to serious, life-threatening toxicity. The blood lead level is the most common and simplest method of measuring lead exposure (2).

In 1987, the Centers for Disease Control and Prevention (CDC) established ABLES. In 1994, North Carolina began monitoring and contributing to the nationwide effort of reducing adult lead exposure by participating in ABLES. The goals of the program are to determine the frequency of elevated blood lead levels (EBLLs) in adults, identify groups commonly exposed, determine reasons for exposure and make prevention recommendations. A mandatory reporting rule in North Carolina requires laboratories to report adult blood lead tests to the state (10 A NCAC 41C .0701 - .0703). The North Carolina public health goal for preventing elevated adult blood lead is to keep the BLL below 10 µg/dL which is consistent with the objective outlined in Healthy People 2020 (3).

Methods

Components of the North Carolina ABLES surveillance system were developed by the national ABLES Program at CDC, National Institute for Occupational Safety and Health (NIOSH). In partnership with state health departments, NIOSH develops case

definitions, collects data, suggests follow-up activities and facilitates data sharing requirements. BLLs are reported to NC ABLES from laboratories via mail, fax and electronically. Results are manually entered into a Microsoft Access database. NC DPH conducts a case investigation to collect facts about circumstances of exposure for persons with BLLs ≥10 µg/dL. Methods to calculate incidence and prevalence for this report are found in the Definitions and Technical Notes section.

Results

During 2011, the ABLES program in North Carolina received 4,891 laboratory reports from 4,448 individuals. The total number of adult blood lead reports received by ABLES has declined over time (Figure 1). The mean BLL of all individuals in 2011 was 4.7 µg/dL, the median was 3.0 µg/dL and the range was 1.0 to 90.0 µg/dL. Most individuals tested, 4,053 (91.1%), had a BLL below 10.0 µg/dL. A total of 395 (8.9%) individuals had a BLL ≥10 µg/dL), specifically 248 (5.6%) had BLLs between 10.0 and 24.0 µg/dL, 127 (2.9%) had BLLs between 25.0 and 39.0 µg/dL, 14 (0.3%) had BLLs between 40.0 and 49.0 µg/dL, 2 (0.0 %) had BLLs between 50 and 59 µg/dL and 4 (0.1%) had a BLL at or above 60.0 µg/dL (Table 1). Prevalence and incidence rates of EBLL (BLL ≥ 10 µg/dL) were generally consistent with past years; however both rates were at their lowest point in 2011. In 2011 the prevalence rate for EBLL ≥ 10 µg/dL was 9.5 and incidence was 6.1(Figure 2) (4). Prevalence and incidence rates for BLLs ≥ 25 µg/dL were similar. For 2011, the prevalence rate for BLL ≥ 25 µg/dL was 3.5 and the incidence rate was 2.0.(Figure 3) (4).

Most individuals tested for blood lead in 2011 were male (75.9%) and males disproportionately accounted for the majority of BLLs ≥ 10 µg/dL (94.7%). Individuals between 25 and 54 years of age accounted for the largest proportion of EBLLs (Table 2).The mean age of all individuals with elevated blood lead was 43.4 and the median was 43.0. The county with the highest number of EBLLS was Forsyth County (Table 4).

Among reports where exposure source was known, 90% of cases reported an occupational source of lead. The industry subsectors with the greatest percentage of EBLLS were primary battery manufacturing (33.8%) followed by highway street and bridge construction (14.8%) and then painting and wall covering contractors (8.8%) (Table 3). In 2009, 78.7% of occupational EBLLs were associated with battery manufacturing. The marked decrease in 2011 is likely due to the downsizing of one of the large battery manufacturers in North Carolina. In 2011, the most common non-occupational lead exposure was associated with taking alternative or complementary medicine (27.3%) (Table 3).

Conclusions

Most individuals tracked by ABLES in North Carolina have normal BLLs. Overall, rates of EBLLs have not changed significantly over time, however rates were lowest in 2011 compared to previous years. North Carolina compares favorably to US prevalence rates. In 2011, 23.7 per 100,000 employed persons reported to the ABLES national database had a BLL ≥10 µg/dL.(5). In regard to EBLLs ≥ 25 µg/dL, annual rates for NC have remained stagnant (Figure 3). Males are tested and have EBLLs much more frequently than females. Documenting information on exposure source has improved and data show that in addition to battery manufacturing, workers are over-exposed to lead in industries such as highway, street and bridge construction and painting and wall-covering contractors. Data are also helping to show why people are exposed to lead outside of work. For example, taking certain complementary or traditional medicinal remedies, target shooting, and loading ammunition are leading reasons for elevated blood lead.

ABLES is critical for recommending intervention. Based on the 2011 surveillance data, outreach should continue to focus on battery manufacturing industries and expand to other industry subsectors with high numbers of EBLLs. 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 for BLLs ≥ 25 µg/dL. NCDOL requests levels meeting this threshold to determine inspection priorities as part of their Lead Special Emphasis Program.

NC ABLES data indicate there are a large number of women in the workplace that are being exposed to lead and being tested as a result of that exposure (1,068 women). Because of dangers to the fetus, CDC recommends pregnant and lactating women maintain a BLL below 5 µg/dL and 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).

Limitations

This report is subject to at least one limitation. 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.

Tables and Figures

Table 1. Distribution of Highest* Blood Lead Levels (BLLs) Among Adults Tested for Blood Lead in NC: 2011

BLL(µg/dL)	All		Exposure Source					
			Occupational		Non-Occupational		Unknown	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
<10	4053	91.1%	21	5.9%	0	0.0%	4032	99.3%
10-24	248	5.6%	209	58.9%	15	44.1%	24	0.6%
25-39	127	2.9%	111	31.3%	13	38.2%	3	0.1%
40-49	14	0.3%	12	3.4%	2	5.9%	0	0.0%
50-59	2	0.0%	2	0.6%	0	0.0%	0	0.0%
≥60	4	0.1%	0	0.0%	4	11.8%	0	0.0%
Total	**4448**	**100.0%**	**355**	**100.0%**	**34**	**100.0%**	**4059**	**100.0%**

Table 2. Distribution of Gender and Age Among Adults Tested for Blood Lead in NC: 2011

Characteristic	BLL (µg/dL)					
	Total		≥ 10		≥ 25	
	Number	Percent	Number	Percent	Number	Percent
Sex*						
Male	3372	75.9%	374	94.7%	140	95.2%
Female	1068	24.1%	21	5.3%	7	4.8%
Total	4440	100.0%	395	100.0%	147	100.0%
Age† (Years)						
16-17	32	0.9%	0	0.0%	0	0.0%
18-24	235	5.7%	16	4.8%	7	6.7%
25-34	767	17.8%	79	23.9%	23	21.9%
35-44	872	19.0%	88	26.6%	33	31.4%
45-54	940	21.3%	78	23.6%	20	19.0%
55-64	781	18.1%	57	17.2%	14	13.3%
65+	659	16.8%	13	3.9%	8	7.6%
Total	4286	100.0%	331	100.0%	105	100.0%

†Age was unknown for 162 individuals

*Sex was unknown for 8 individuals

Table 3. Distribution of Occupational and Non-Occupational Lead Exposure* in NC: 2011

Industry Code †	Industry Title	BLL (µg/dL)					
		All		≥10 µg/dL		≥25 µg/dL	
		Number	Percent	Number	Percent	Number	Percent
Occupational							
236220	Commercial and Institutional Building Construction	7	2.0%	7	2.1%	2	1.6%
237310	Highway, Street, and Bridge Construction	53	15.0%	49	14.8%	22	17.6%
238120	Structural Steel and Precast Concrete Contractors	4	1.1%	4	1.2%	1	0.8%
238220	Plumbing, Heating, and Air-Conditioning Contractors	6	1.7%	6	1.8%	2	1.6%
238320	Painting and Wall Covering Contactors	30	8.5%	29	8.8%	12	9.6%
238910	Site Preparation Contractors	1	0.3%	1	0.3%	0	0.0%
314991	Rope, Cordage, and Twine Mills	1	0.3%	1	0.3%	0	0.0%
325188	All Other Basic Inorganic Chemical Manufacturing	38	10.8%	31	9.4%	19	15.2%
327211	Flat Glass Manufacturing	1	0.3%	1	0.3%	0	0.0%
327212	Other Pressed and Blown Glass Manufacturing	1	0.3%	1	0.3%	0	0.0%
327215	Glass Product Manufacturing Made of Purchased Glass	1	0.3%	1	0.3%	1	0.8%
331111	Iron and Steel Milling	24	6.8%	19	5.7%	9	7.2%
331422	Copper Wire (except Mechanical) Drawing	27	7.6%	26	7.9%	0	0.0%
332116	Metal Stamping	1	0.3%	1	0.3%	1	0.8%
332994	Small Arms Manufacturing	4	1.1%	3	0.9%	1	0.8%
332999	Miscellaneous Fabricated Metal Product Manufacturing	12	3.4%	12	3.6%	4	3.2%
335911	Storage Battery Manufacturing	1	0.3%	1	0.3%	0	0.0%
335912	Primary Battery Manufacturing	112	31.7%	112	33.8%	43	34.4%
339920	Sporting and Athletic Goods Manufacturing	1	0.3%	0	0.0%	0	0.0%
484230	Specialized Freight (except Used Goods) Trucking, Long-Distance	1	0.3%	1	0.3%	0	0.0%
488390	Other Support Activities for Water Transportation	1	0.3%	1	0.3%	0	0.0%
561612	Security Guards and Patrol Services	6	1.7%	5	1.5%	1	0.8%
562910	Remediation Services	4	1.1%	4	1.2%	0	0.0%
562991	Septic Tank and Related Services	1	0.3%	1	0.3%	0	0.0%
611519	Other Technical and Trade Schools	1	0.3%	1	0.3%	0	0.0%
711510	Independent Artists, Writers, and Performers	3	0.8%	2	0.6%	0	0.0%
713990	All Other Amusement and Recreation Industries	9	2.5%	9	2.7%	6	4.8%
928110	National Security	2	0.6%	2	0.6%	1	0.8%
Total Exposed at Work		353	100.0%	331	100.0%	125	100.0%
Non-occupational							
Shooting Firearms		4	18.2%	4	18.2%	0	0.0%
Taking complementary alternative medicines		6	27.3%	6	27.3%	3	30.0%
Remodeling/renovating/painting		1	4.5%	1	4.5%	1	10.0%
Casting (e.g., bullets, fishing weights)		1	4.5%	1	4.5%	1	10.0%
Other - Hard wear in leg and foot		5	22.7%	5	22.7%	3	30.0%
Other - Lead Loader		4	18.2%	4	18.2%	2	20.0%
Retained bullets (gunshot wound)		1	4.5%	1	4.5%	0	0.0%
Total exposed at places other than work		22	100.0%	22	100.0%	10	100.0%

* Industry code unknown for 2 occupational cases and activity unknown for 12 non-occupational cases

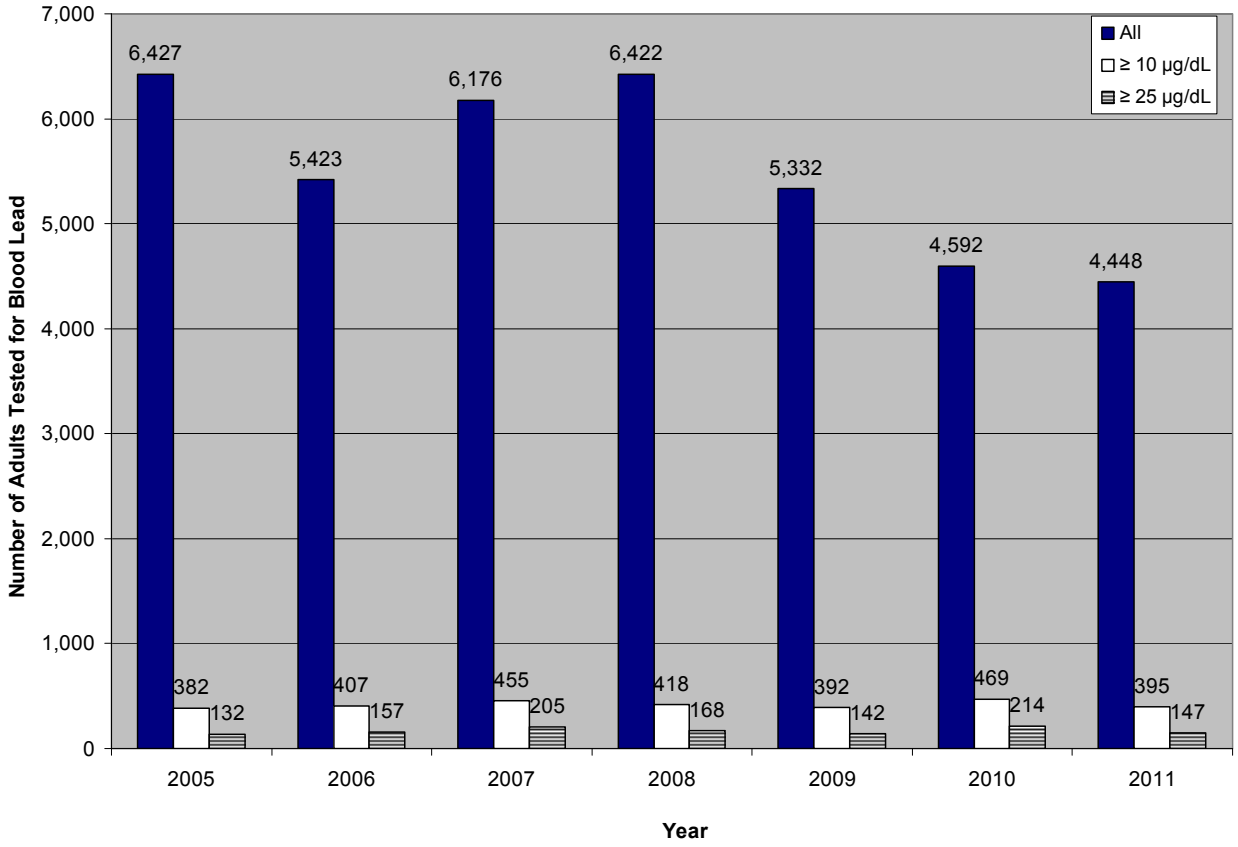
† North American Industry Classification System

Table 4: Distribution of County of Exposure Among Adults Tested for Blood Lead in NC: 2011

County	BLL (µg/dL)					
	Total		≥10		≥25	
	Number	Percent	Number	Percent	Number	Percent
Forsyth	159	46.9%	152	47.6%	66	55.9%
New Hanover	44	13.0%	42	13.2%	17	14.4%
Mecklenburg	28	8.3%	22	6.9%	10	8.5%
Nash	28	8.3%	27	8.5%	1	0.8%
Onslow	22	6.5%	22	6.9%	8	6.8%
Sampson	13	3.8%	13	4.1%	4	3.4%
Other Counties* (20)	45	13.3%	41	12.9%	12	10.2%
Total	339	100.0%	319	100.0%	118	100.0%

*Counties with EBLLs <10

Figure 1. Total Number of Blood Lead Laboratory Reports Received in NC: 2005-2011



*Employment Data provided by the US Bureau of Labor Statistics.[3]

Figure 2. Prevalence and Incidence* of North Carolina Adults with Blood Lead Levels of ≥10 µg/dL per 100,000 Employed Persons: 2005 -2011

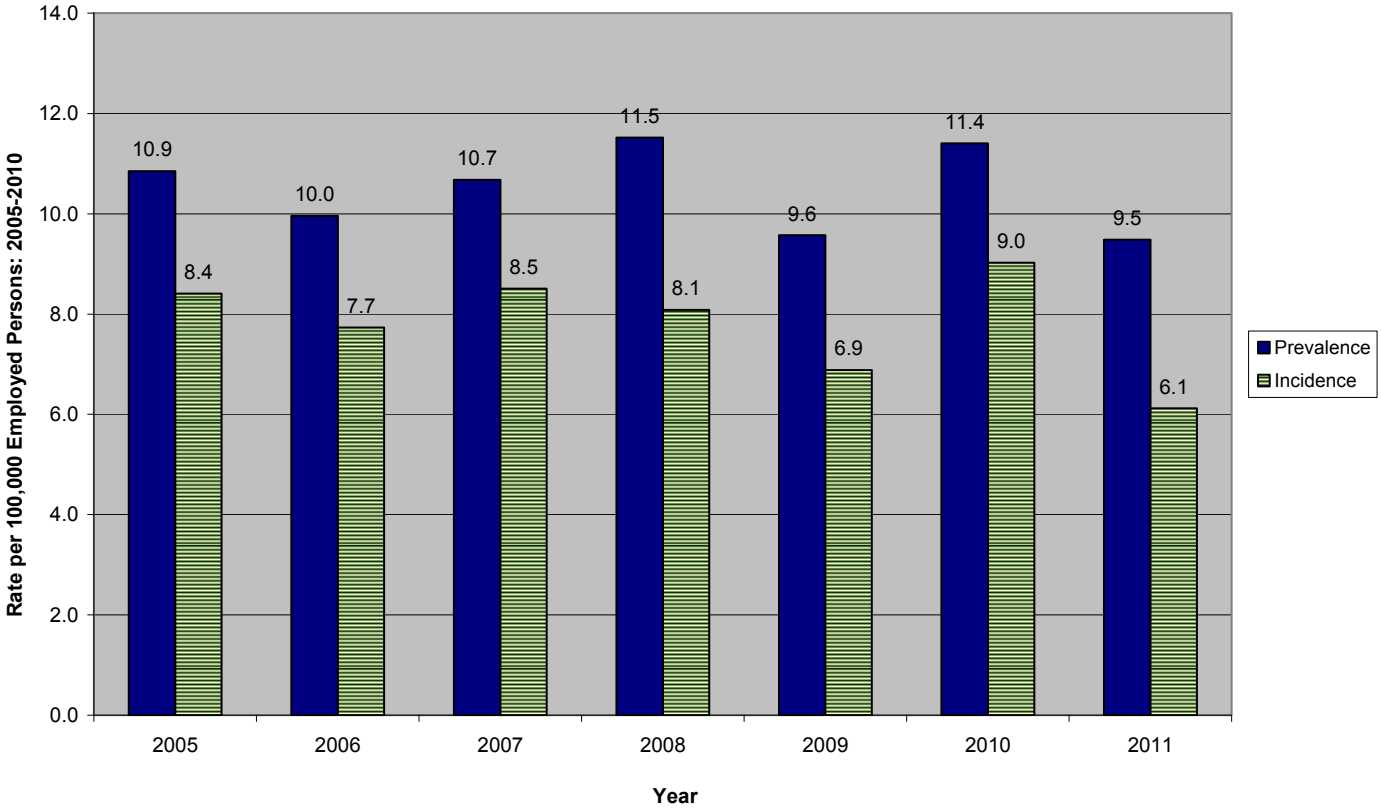
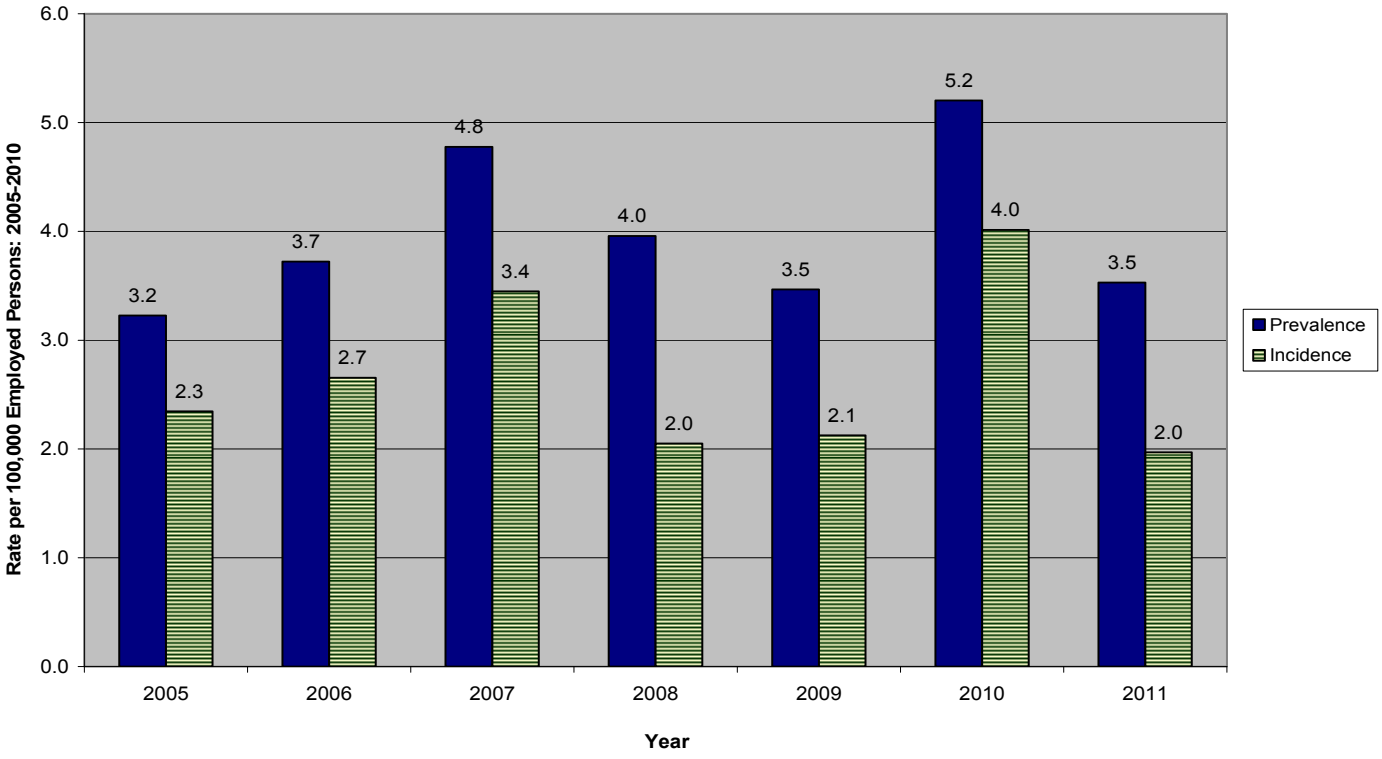


Figure 3. Prevalence and Incidence* of North Carolina Adults with Blood Lead Levels of ≥25 µg/dL per 100,000 Employed Persons: 2005-2011



*Employment Data provided by the US Bureau of Labor Statistics.

Definitions and Technical Notes

ABLES: Adult Blood Lead Epidemiology and Surveillance.

Adult: Residents age 16 or older.

BLL: Blood lead level.

Incident BLL: For individuals with more than one BLL reported for 2011, only the highest BLL was used for analysis.

EBLL: Elevated blood lead level. In 2009, ABLES lowered its case definition for an EBLL from a BLL ≥ 25 µg/dL to a BLL ≥ 10 µg/dL. The definition for this report is a BLL ≥ 10 µg/dL.

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

Formula: (Annual number of adult residents with a BLL ≥ 10 µg/dL reported in the calendar year, but not reported with a BLL ≥ 10 µg/dL in the immediately preceding year / annual number of employed adults) x 100,000.[4]

Employment Data: Annual employment data were collected from the *Geographic Profile of Employment and Unemployment* for the years 2005-2011. 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 µg/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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7. CDC. (2004) Lead exposure among females of childbearing age --- United States, MMWR. April 27, 2007/ 56 (16): 397-400.

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