NEW HAMPSHIRE

Healthy Homes & Lead Poisoning Prevention Program

2014 Lead Exposure Surveillance Report

Department of Health and Human Services

Division of Public Health Services

Bureau of Public Health Protection

Healthy Homes & Lead Poisoning Prevention Program

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ENSURING THE HEALTHY DEVELOPMENT OF NEW HAMPSHIRE CHILDREN

Few would disagree that the future is in the hands of our children and that we have a responsibility to ensure they grow up healthy and strong. Each of us, in our own way, must be a strong advocate offering them a future with possibilities that are wide open. Keeping our children away from lead exposures will go a long way to ensure that their developing minds and bodies reach their full potential.

While many people understand the sources of lead and ways to avoid lead exposures, children continue to be exposed through deteriorated lead-based paint, renovation activities in older housing, contaminated soil, water, and other domestic sources. Lead is a developmental neurotoxicant, and when young children are exposed to lead, it causes elevated blood lead levels (EBLL) that can impair intellectual functioning and cause behavioral problems that last a lifetime[i] (Patrick N. Breysse, 2015).

Primary prevention strategies that control or eliminate lead sources before children are exposed remain the pre-eminent public health approach to the problem of lead poisoning and are the only effective way to prevent the neurodevelopmental and behavioral abnormalities associated with lead exposure (Patrick N. Breysse, 2015). Using primary prevention to eliminate EBLLs remains a priority at the national level, along with the Department of Health and Human Services, and New Hampshire's newly formed Childhood Poisoning Prevention & Lead Screening Commission. Unfortunately, hundreds of thousands of New Hampshire children have already experienced EBLL known to impair academic performance and affect life success (HHLPPP, 2014). This population with EBLL is having an impact on the resources of our educational system and juvenile justice system. Exposing our children to lead is not an option that New Hampshire can continue to afford. The present value of New Hampshire's economic losses attributable to lead exposure in the 2013 cohort of 5-year olds was estimated to be $240 million (Chiahui Chawla, 2014).

> *…elevated blood lead levels can impair intellectual functioning and cause behavioral problems that last a lifetime.*

WHY CHILDREN ARE VULNERABLE TO LEAD EXPOSURE

There is no safe level of lead in the blood and the damage from lead exposure has life-long effects. Children are more at risk for lead exposure as they learn to crawl and walk, and are constantly on the floor, prone to ingesting and inhaling dust contaminated with lead. Their smaller bodies are in a continuous state of growth and development and lead is absorbed at a faster rate compared to adults. This causes more physical harm in children than in adults (Preventon, 2014).

Experts from the Centers for Disease Control and Prevention's (CDC) Advisory Committee on Childhood Lead Poisoning Prevention (ACCLPP) now use a reference level of 5 micrograms per deciliter to identify children with blood lead levels that are much higher than most children's levels. This new level is based on the U.S. population of children ages 1-5 years who are in the highest 2.5% of children when tested for lead in their blood. This reference value is based on the 97.5th percentile of the National Health and Nutrition Examination Survey (NHANES)'s blood lead distribution in children. CDC will update the reference value every four years using the two most recent NHANES surveys. Until recently, children were identified as having a blood lead "level of concern" if the test result is 10 or more micrograms per deciliter of lead in blood. CDC is no longer using the term "level of concern" and is instead using the reference value to identify children who have been exposed to lead and who require case management. In the past, blood lead level tests below 10 micrograms per deciliter of lead in blood may, or may not, have been reported to parents. The new lower value means that more children will likely be identified as having lead exposure allowing parents, doctors, public health officials, and communities to take action earlier to reduce the child's future exposure to lead. (Wheeler and Brown 2013).

HOW LEAD EXPOSURE IMPACTS NEW HAMPSHIRE'S CHILDREN

As early as 1943, a study by Byers and Lord recognized that children with severe lead intoxication suffered from neurobehavioral problems such as impulsivity, aggression, and short attention span. Throughout the 1980's and 1990's, studies by Hatzakis et al. 1985; Hunter et al. 1985; Needleman et al. 1979; Raab et al. 1990; Thomson et al. 1989; and Winneke et al. 1990 supported and expanded the link between lead exposure and cognitive growth. The CDC and the Advisory Committee on Childhood Lead Poisoning Prevention recently convened a work group of recognized experts to review the existing scientific evidence for adverse effects of blood lead levels on academic performance and describe actionable steps that clinical and public health practitioners, parents, and educators can take to ensure that the children receive such services. From this workgroup, in April 2015, the CDC published the *Educational Interventions for Children Affected by Lead* summarizing past and current data demonstrating the compelling body of evidence linking EBLL to the brain's learning systems: overall intellectual ability, speech and language, hearing, visual-spatial skills, attention, executive functions, social behavior, and fine and gross motor skills. **Table 1,** on the following page, summarizes but a few of the studies outlined in this new groundbreaking report linking low level EBLL to decreased math, reading and science test scores, learning disabilities, in addition to increased special education and juvenile justice costs.

In New Hampshire during 2014, of the 10,281 5 year-olds who were tested for lead at some point in their lives, a total of 1,554 (15%) had an EBLL greater than or equal to 5 mcg/dL. Most of these children will be entering Kindergarten within the next year.

…15.2% of five year olds have been exposed to lead greater than 5mcg/dL at some time in their lives.

In 2014, 195,452 children (ages 6-18) were enrolled in New Hampshire Schools grades K-12. Using blood lead surveillance data from 1996-2014, an estimated 72,024 children between the ages of 6 and 18 had a reported venous or capillary EBLL greater than or equal to 5mcg/dL at some point in their lives. While the data does not include those children not tested, or those who moved out of New Hampshire in the time frame, the HHLPPP estimates that this number represents about 37% of children currently enrolled in New Hampshire schools, who had an EBLL greater than 5mcg/dL at some point in their lives.

Table 1 - Studies on Lead and Educational Outcomes

EBLL Micrograms per deciliter	Educational Impact	Size of Study	Location of Study
≤ 3 mcg/dL	Decreased end of grade test scores	More than 57,000 children	North Carolina (Miranda et al. 2009)
4 mcg/dL at 3 years of age	Increased likelihood learning disabled classification in elementary school Poorer performance on tests	More than 57,000 children 35,000 children	North Carolina (Miranda et al. 2009) Connecticut (Miranda et al. 2011)
5 mcg/dL	30% more likely to fail third grade reading and math tests More likely to be non-proficient in math, science, and reading	More than 48,000 children 21,000 children	Chicago (Evens et al. unpublished data) Detroit (Zhang et al. 2013)
5-9 mcg/dL	Scored 4.5 points lower on reading readiness tests	3,406 children	Rhode Island (McLaine et al. 2013)
≥10 mcg/dL	Scored 10.1 points lower on reading readiness tests	3,406 children	Rhode Island (McLaine et al. 2013)
10 and 19 mcg/dL	Significantly lower academic performance test scores in 4th grade	More than 3,000 children	Milwaukee (Amato et al. 2012)
≥ 25 mcg/dL	$0.5 million in excess annual special education and juvenile justice costs	279 children	Mahoning County, Ohio (Stefanak et al. 2005)

This groundbreaking report summarizes study after study that demonstrates a direct association between low level EBLLs with poorer performance on tasks requiring focused attention, cognitive flexibility, and inhibition of automatic response. Deficits in IQ and other formal measures of cognitive attainment may not be among the most important and persistent effects of early exposure to lead. Exposure may be associated with a higher risk for developing ADHD or at least some of its behavioral features. Prospective studies of lead and child development have linked high EBLLs with destructive and aggressive behaviors during the preschool years and early adolescence (Burns et al. 1999; Wasserman et al. 1998). Children with lead exposure cannot avoid the negative impact on their neurodevelopmental abilities. Once a child's health or cognition has been harmed by lead, the effects can be permanent and continue into adulthood. In reviewing the recently this recently released report, lead's "Neurobehavioral Signature" -- the many areas of child's development negatively and irreversibly impacted by lead exposure *(*including domains of attention, executive function, visual-spatial, social/behavior/emotional regulation, speech and language development, and fine and gross motor skills*)* becomes clear. Review will include expanded focus on the education needs of children affected by lead and key interventions provided by early childhood education systems that will best support the academic performance and other outcomes of these children (Patrick N. Breysse, 2015).

TESTING CHILDREN FOR LEAD EXPOSURE

Identifying Screening Approaches for Communities with Varying Risk: Universal vs. Target

The Department of Health and Human Services, *New Hampshire Childhood Lead Screening and Management Guidelines,* recommend that medical providers universally screen young children for lead who reside in communities that are high risk. High risk communities include those with 27% or more pre-1950 housing where deteriorating lead-based paint is most likely to exist. Many communities are at even higher risk for lead exposure due to several factors. These factors include the percentage of homes built prior to 1950, the percentage of the population under the age of six; the percentage under the age of six living in poverty; the percentage of children under the age of six insured by Medicaid, enrolled in WIC, Head Start or Early Head Start; having special populations (e.g. refugees, select industries) and history of EBLL. Of New Hampshire's 234 communities, 57% or 133 communities are high risk. Medical providers who have patients residing in these communities are recommended to universally test all one and two year olds for

…57% or 133 NH cities/towns are high risk where it is recommended to universally test all 1 and 2 year olds.

lead exposure. If a child under the age of six years old has not previously been tested for lead exposure or who has new risk factors, the *Guidelines* recommend the medical provider test the child for lead exposure. New risk factors may include relocating to a new address, attending a Day Care built before 1978, or having a sibling with an EBLL.

The *New Hampshire Childhood Lead Screening and Management Guidelines* recommend that medical providers in the remaining 101 (43%) communities use a targeted approach to testing children for lead exposure. Medical providers have been provided a 5-question assessment tool to determine the risk level for children under the age of six have to lead exposure. A positive or uncertain response to any of the five questions prompts the medical provider to test the child for lead exposure.

Additionally, all children insured by Medicaid, regardless of town of residence, are required to be tested for lead exposure at both one and two years of age. Older children, aged three to six, not previously tested for lead exposure should be tested. It is also recommended that children enrolled in WIC, Head Start and Early Head Start be tested for lead poisoning. The ACCLPP and DHHS also recommend that any refugee, immigrant, or internationally adopted child be tested, and that neonates and infants born to mothers exposed to lead or with a high blood lead level during pregnancy or lactation should be tested.

Blood Lead Collection and Analytical Techniques

In Universal or Target communities, collection of a blood lead sample from a child is routinely completed by one of two techniques that include either a capillary finger stick or a venous blood draw. Samples collected using a capillary finger stick are most commonly analyzed using a portable instrument providing real-time analysis. These instruments are convenient and inexpensive and when good sampling techniques are used, the analytical detection limit is 3.3 micrograms per deciliter. There are 29 such portable testing instruments located throughout the state in offices of medical providers, laboratories, and WIC clinics, each certified by the Clinical Laboratory Improvement Amendment (CLIA).

Any child having an EBLL that is 5 mcg/dl or higher from a capillary sample should have their EBLL confirmed with a venous draw blood test.

Medical providers often refer patients to have their blood lead collected by a phlebotomist at a laboratory using a venous blood draw technique. Though some laboratories have the analytical instrumentation on-site to analyze blood lead samples, the majority of blood lead samples are

shipped to out-of-state laboratories where they are analyzed by atomic absorption-flame or graphite furnace, or inductively coupled plasma-mass spectrophotometry instrumentation. Detection limits for these instruments range from 0.1 to 2.0 mcg/dl (Organization, 2011). Any child having an EBLL that is 5 mcg/dl or higher from a capillary finger stick should have their EBLL confirmed with a venous draw blood test.

New Hampshire's Eight Highest Risk Communities

Through a review of surveillance data, the DHHS has identified eight New Hampshire communities where children are especially vulnerable to the dangers of lead exposure. Risk factors are outlined in **Table 2** and include the percentage of homes built prior to 1950, the percentage of the population under the age of six; the percentage under the age of six living in poverty; the percentage of children under the age of six insured by Medicaid, enrolled in WIC, Head Start or Early Head Start; having special populations (e.g. refugees, select industries) and history of EBLL. The communities identified as highest risk include Berlin, Claremont, Newport, Franklin, Laconia, Manchester, Nashua, and Rochester. The Cities of Manchester, Nashua, and Laconia are the home of special refugee populations in addition to other risk factors. Concord also has special populations, though it does not exhibit other risk factors making it a "highest risk" community. The City of Berlin has the largest percent of old homes with 61% of homes built prior to 1950. Rochester is especially vulnerable with 21% of children under 6 years old living in poverty. Manchester follows closely with 25% of children under the age of 6 living in poverty. Laconia has the largest percent, 77% of 0-5 year olds enrolled in Public Health Insurance such as Medicaid followed by Claremont at 70%.

Table 2 – New Hampshire's Eight Highest Risk Communities

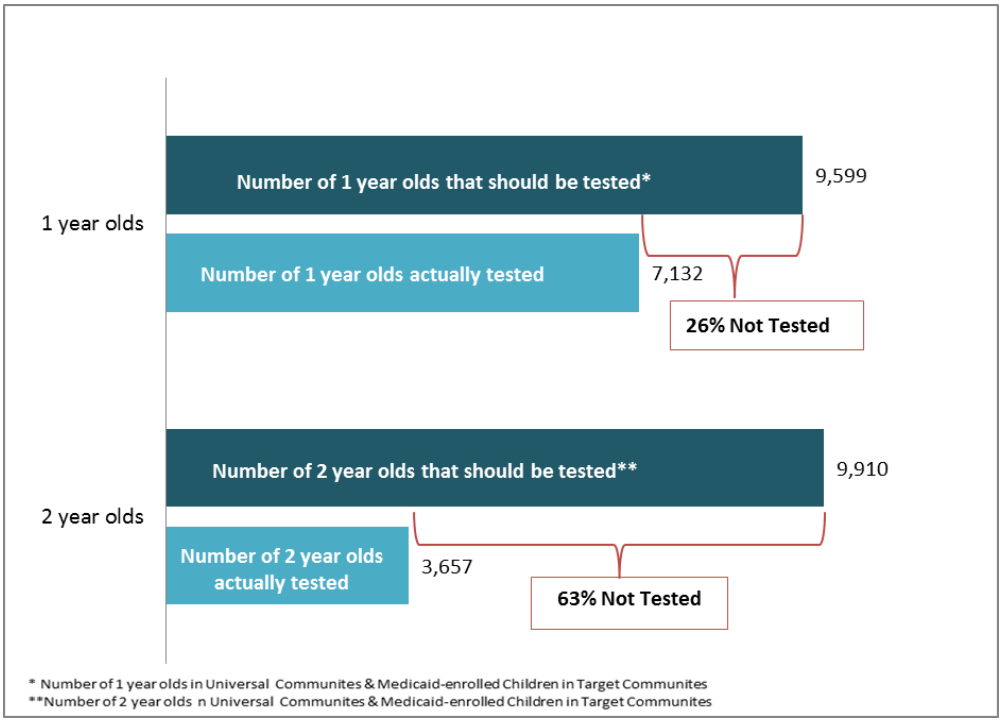
US Census & 2009-2013 American Community Survey

Town/City	#EBLL >10mcg/dL 2009-2014	% Pre-1950s Housing	% Under 6 Below Poverty	% Living in Rental Units	% Public Insurance	Refugee Resettlement Area
Manchester	517	48%	25%	51%	50%	Yes
Nashua	104	22%	15%	41%	35%	Yes
Rochester	44	24%	32%	33%	50%	No
Claremont	32	48%	21%	38%	70%	No
Franklin	32	49%	21%	35%	44%	No
Laconia	26	40%	24%	40%	77%	Yes
Newport	13	41%	15%	23%	27%	No
Berlin	11	61%	17%	32%	46%	No

Declining Testing Rates for Children for Lead Exposure

According to the 2010 U.S. Census, there are 84,767 children under the age of six residing in the State of New Hampshire. Of these children, 27,480 are one and two year olds, our most vulnerable age for lead exposure. According to the U.S. Census, 19,509 of these 1 and 2 years old (71 %), live in high risk communities or are one and two year olds insured by Medicaid, where medical providers are recommended to universally test this population for lead exposure. **Chart 1**, below illustrates the historical overview of lead testing for one and two year olds statewide. Testing rates have remained flat and in some communities have declined over recent years (HHLPPP, 2014). The successful passing of Senate Bill 135 in July 2015 includes requirements intended to improve New Hampshire's screening rates, especially for children in high-risk communities, including an 85% screening rate milestone for one- and two-year olds in universal testing communities, enrolled in Medicaid, WIC or Head Start. The new law established a Childhood Lead Poisoning Prevention and Screening Commission, to address barriers to testing children for lead exposure.

Chart 1 – 2014 testing rates for one and two year olds for lead exposure



Testing One and Two Year Olds in Our Eight Highest Risk Communities

Many factors influence how successful a community may be in testing their children for lead exposure. These factors include the number of portable blood lead testing instruments situated in local medical provider offices and WIC clinics, the understanding of the physician and family of the risk lead exposure poses, the proximity of the testing laboratory to the provider office, and the

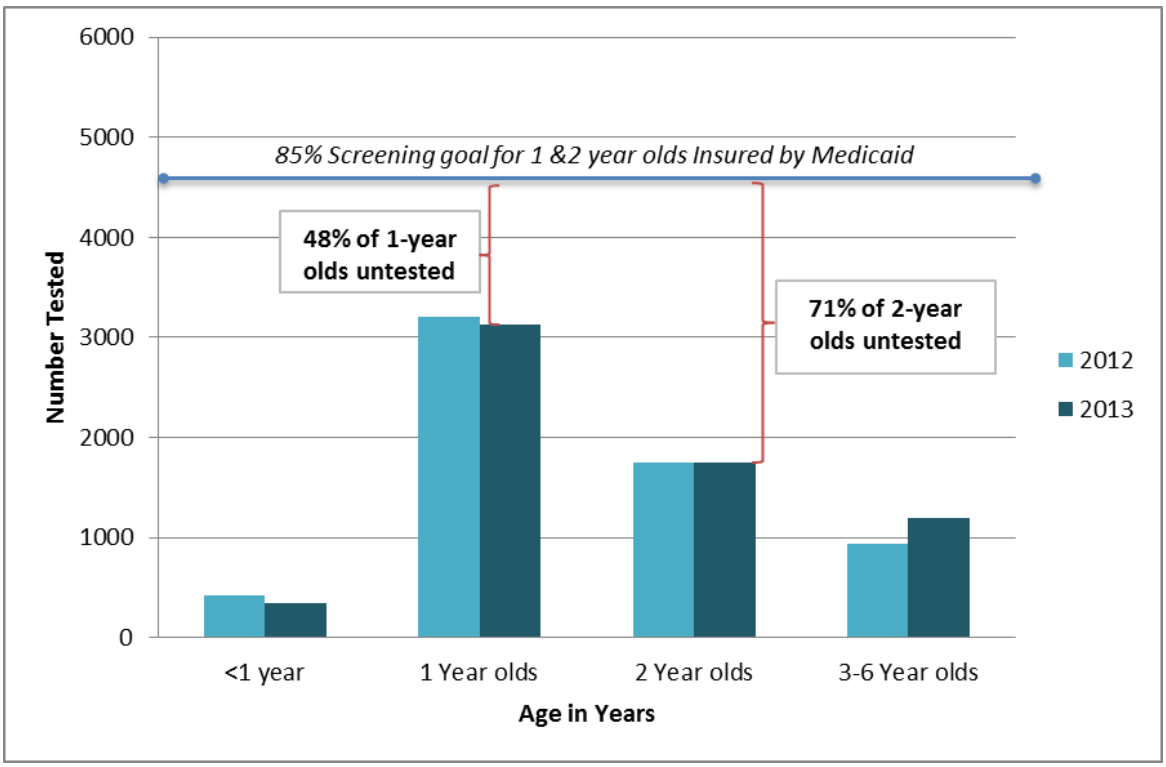
ability of families to find transportation to a testing laboratory. The City of Berlin continues to have the highest testing rates for one and two year olds statewide. Testing rates for one year olds in the other highest risk communities range from 100% in Berlin to 43% in Laconia. Testing rates for two year olds in these same communities range from a high of 63% in Berlin to 22% in Franklin, Newport, and Laconia. **Table 3** on page 11 includes the testing rates for the other six communities in addition to statewide data.

Testing Children under the Age of Six Insured by Medicaid

In 2013, children receiving Medicaid benefits represented 83% of all children statewide with an EBLL greater than or equal to 10 mcg/dL. Though it is a federal requirement that children under the age of six insured by Medicaid be tested for lead, in 2013, only 52% of one year olds, and 29% of children two years of age insured by Medicaid were tested for lead exposure. **Chart 3**, on the following page, shows historical testing data for Medicaid enrolled children years 2009 to 2013.

In 2013, children insured by Medicaid represent 83% of all children statewide with an EBLL greater than or equal to 10mcg/dl.

Chart 2 – Children < 6yo. insured by Medicaid who were tested for lead, 2012-2013



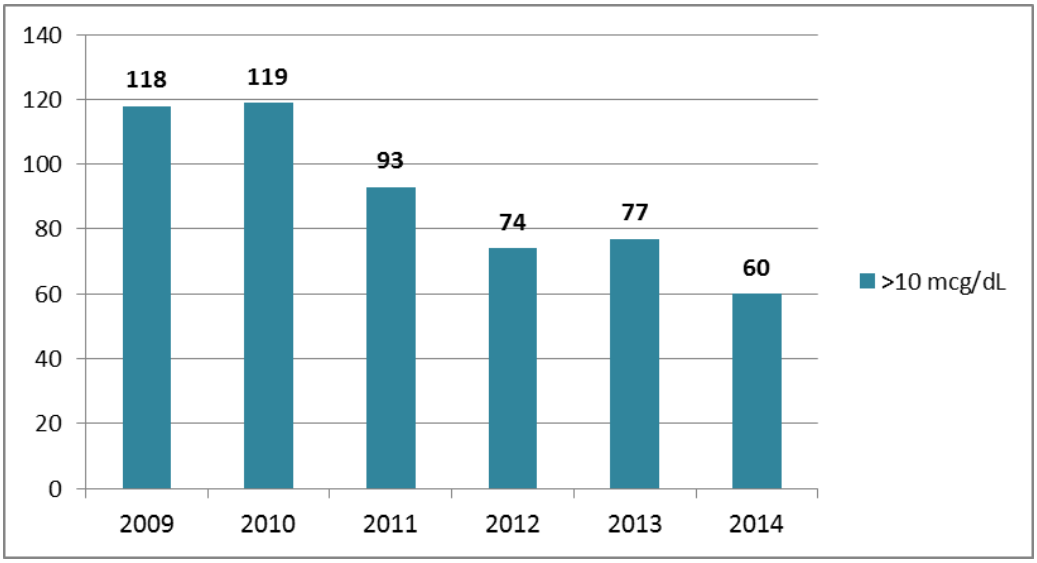
Cost of Preventive Testing

The cost of a single blood lead test averages $38 (in 2013 dollars), including the test and the venous blood draw (Chiahui Chawla, 2014). Applied to 19,509 children ages 1 and 2 living in high risk communities and one and two year olds insured by Medicaid that should be universally tested, the cost of preventive screening in New Hampshire was $741,342. The costs for blood lead tests are reimbursed by Medicaid and most private health insurance.

CHILDREN WITH ELEVATED BLOOD LEAD LEVELS

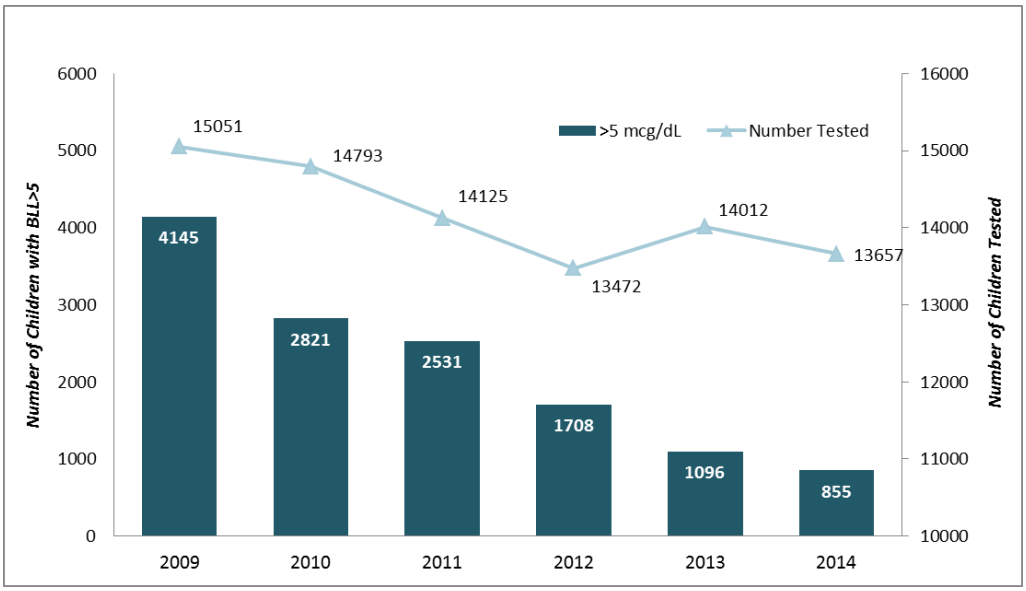
In 2014, 855 additional New Hampshire children under the age of six had an EBLL above 5 mcg/dL. Of these, sixty children had an EBLL above 10 mcg/dL, resulting in an environmental investigation and care coordination through the DHHS, Division of Public Health Services, Healthy Homes and Lead Poisoning Prevention Program (HHLPPP). Two New Hampshire children under the age of six had EBLL greater than 45 mcg/dl; one resulting in medical chelation treatment at Elliot Hospital in Manchester. **Chart 3**, below, provides a historical overview of children with EBLLs from 2009 to 2014.

Chart 3 - Children <6 yo. with confirmed EBLL greater or equal to 10 mcg/dL in 2009 - 2014



At quick glance, **Chart 3** would lead you to believe that lead exposure as a risk to our children is a thing of the past and that the number of children exposed annually is declining. **Chart 4** below compares the number of children under the age of six that had EBLL above 5 mcg/dl compared to the number of children under the age of six that are tested annually for lead exposure statewide.

Chart 4 – A comparison of children <6 yo. with EBLL ≥ 5mcg/dL and the number of children <6 yo. tested statewide 2009 - 2014



Elevated Blood Lead and Testing Rates by Town and State Summary Data

Table 3, on the following page, represents childhood blood lead testing data for children 0-6 years of age for New Hampshire's eight highest risk communities; Berlin, Franklin, Laconia, Newport, Claremont, Rochester, Manchester, and Nashua. At the bottom of the table you will see statewide summary data. Please note in this **Table 3**, that the 117.3% testing rate in Berlin for the 12-23 month old age group is based on the denominator of 75 children in that age group in Berlin in accordance with the 2010 U.S. Census. A test is defined as any test in the 2014 calendar year where the child has never had a confirmed elevation and only includes one test per child for time frame because the child is only included in denominator (population) once. Please note that the numerator for the age-based screening rate is calculated based on the date of testing.

During the 2016 calendar year, the DHHS, Healthy Homes and Lead Poisoning Prevention Program will partner with the Environmental Public Health Tracking Program, to re-evaluate the highest risk communities throughout the state. In addition to reviewing the traditional risk factors, HHLPPP will review social vulnerability index factors down to the Census track level, when available. Social Vulnerability Index factors include poverty, minority status, age, vehicle availability, and housing. This re-evaluation of community risk will allow the HHLPPP and partners receiving funding from the U.S. Department of Housing and Urban Development to target resources to those most in need.

Table 3 – 2014 lead testing in New Hampshire's highest risk communities

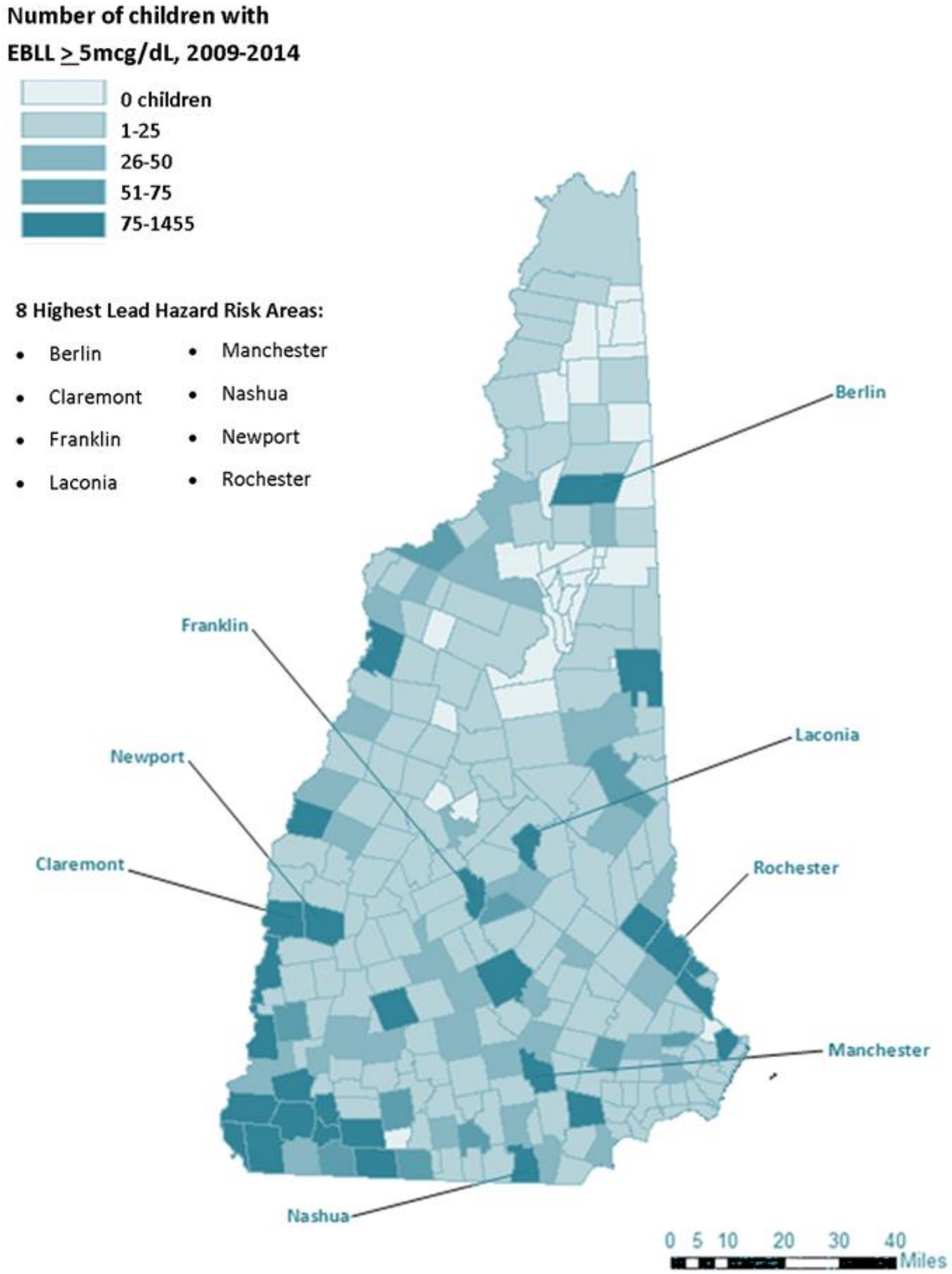
Town	Age Group	Number Screened	US Census 2010 Pop***	Screening rate*	5-9 Venous and Capillary Tests	10-14 Venous Test Only	15-19 Venous Test Only	20+ Venous Test Only	% Elevations/ screens
Berlin	0-11 mos	7	87	8.0%	1	0	0	0	0.0%
	12-23 mos	88	75	117.3%	7	0	0	0	0.0%
	24-35 mos	64	102	62.7%	5	0	0	0	0.0%
	36-71 mos	60	284	21.1%	8	0	0	0	0.0%
	Total	**219**	**548**	**40.0%**	**21**	**0**	**0**	**0**	**0.0%**
Claremont	0-11 mos	2	128	1.6%	1	0	0	0	0.0%
	12-23 mos	91	172	52.9%	11	1	0	0	1.1%
	24-35 mos	52	177	29.4%	10	0	0	1	1.9%
	36-71 mos	49	526	9.3%	4	0	0	0	0.0%
	Total	**194**	**1003**	**19.3%**	**26**	**1**	**0**	**1**	**1.0%**
Franklin	0-11 mos	10	99	10.1%	2	0	0	0	0.0%
	12-23 mos	87	96	90.6%	15	2	0	0	2.3%
	24-35 mos	35	95	36.8%	6	0	0	0	0.0%
	36-71 mos	29	318	9.1%	4	1	0	0	3.4%
	Total	**161**	**608**	**26.5%**	**27**	**3**	**0**	**0**	**1.9%**
Laconia	0-11 mos	9	178	5.1%	2	0	0	0	0.0%
	12-23 mos	77	178	43.3%	4	0	0	0	0.0%
	24-35 mos	39	174	22.4%	2	0	0	0	0.0%
	36-71 mos	34	506	6.7%	2	0	0	0	0.0%
	Total	**159**	**1036**	**15.3%**	**10**	**0**	**0**	**0**	**0.0%**
Manchester	0-11 mos	87	1525	5.7%	4	0	0	0	0.0%
	12-23 mos	976	1512	64.6%	48	2	2	1	0.5%
	24-35 mos	615	1498	41.1%	28	3	1	0	0.7%
	36-71 mos	287	4165	6.9%	38	0	0	0	0.0%
	Total	**1965**	**8700**	**22.6%**	**131**	**5**	**3**	**1**	**0.5%**
Nashua	0-11 mos	52	1076	4.8%	3	0	0	0	0.0%
	12-23 mos	720	1088	66.2%	55	1	0	0	0.1%
	24-35 mos	310	1078	28.8%	24	2	0	0	0.6%
	36-71 mos	151	3274	4.6%	11	0	0	0	0.0%
	Total	**1233**	**6516**	**18.9%**	**95**	**3**	**0**	**0**	**0.2%**
Newport	0-11 mos	9	178	5.1%	0	0	0	0	0.0%
	12-23 mos	77	178	43.3%	4	0	0	0	0.0%
	24-35 mos	39	174	22.4%	3	0	0	0	0.0%
	36-71 mos	34	506	6.7%	2	0	0	0	0.0%
	Total	**159**	**1036**	**15.3%**	**9**	**0**	**0**	**0**	**0.0%**
Rochester	0-11 mos	19	333	5.7%	3	0	0	0	0.0%
	12-23 mos	209	384	54.4%	17	1	0	0	0.5%
	24-35 mos	170	380	44.7%	11	0	0	0	0.0%
	36-71 mos	76	1043	7.3%	12	1	0	0	1.3%
	Total	**474**	**2140**	**22.1%**	**44**	**2**	**0**	**0**	**0.4%**
NH Total	0-11 mos	859	12994	6.5%	54	2	0	2	0.7%
	12-23 mos	7132	13521	52.5%	389	15	6	0	0.4%
	24-35 mos	3657	13959	26.4%	207	14	6	2	0.5%
	36-71 mos	2009	44293	4.5%	145	10	2	1	0.2%
	Total	**13657**	**84767**	**16.1%**	**795**	**41**	**14**	**5**	**0.4%**

***SCREENS = any test in this CY where the child has never had a confirmed elevation, only includes one test per child for time frame because child is only included in denominator (pop) once**

NOTE: Numerator age for screen rate is calculated at time of test date

*****U.S. Census 2010, Summary File 1, Table PCT12, Sex by Age**

Map 1 – New Hampshire Children <6 yo. with EBLL > 5mcg/dL by Town, 2009-2014



Administrative Orders of Lead Hazard Reduction and Fines

During the 2014 calendar, under the authority of RSA 130-A, the HHLPPP issued 82 Administrative Order of Lead Hazard Reduction (Order) to thirty five property owners to reduce all lead exposure hazards associated with the dwelling and dwelling units. Of these Orders, 17 resulted in non-compliance and received Administrative Fines; none of which have been paid. In addition, three Administrative Fines were issued to Lead Professionals for worksite compliance. These Fines have been collected.

ELEVATED BLOOD LEAD IN ADULTS

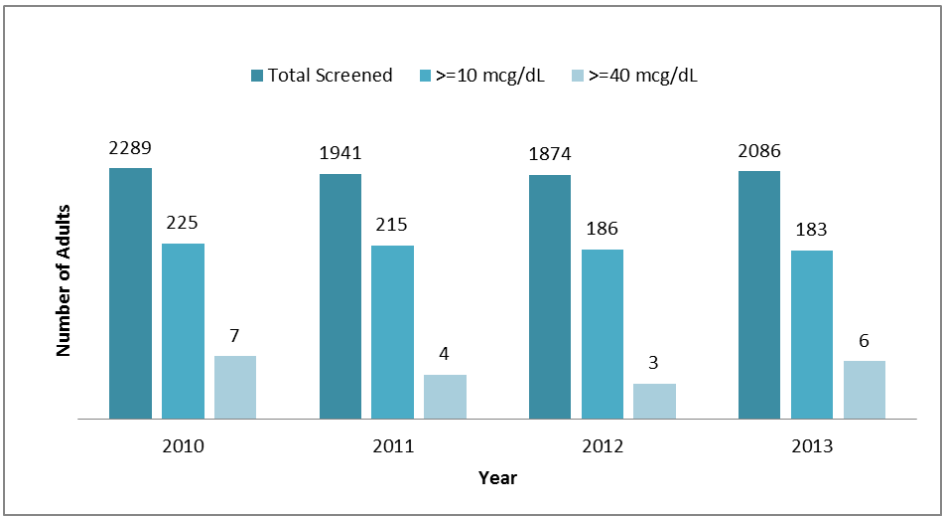
Most adults that are exposed to lead are exposed through their employment or hobbies. The U.S. Occupational Safety & Health Administration (OSHA) blood lead regulations mandate that employers with workers exposed to lead must provide medical monitoring to their employees who, on any given day, are exposed to airborne lead above the "action level" of 30 mcg/m3 (micrograms per cubic meter of air).

Under the current OSHA standard, if an employee has an EBLL greater than 40 mcg/dL, he or she must be removed from the work area. Whenever the results of a blood lead test indicate that an employee's blood lead level exceeds the acceptable OSHA standard, the employer must provide a follow-up blood test within two weeks after the first test. If an employee is removed from work because of an exposure leading to an EBLL the employee must have a repeat blood lead test again after one month and then every two months until two consecutive blood tests indicate a blood lead level below 40 mcg/dL.

The National Institute of Occupational, Safety, and Health Administration (NIOSH) have designated 10 mcg/dL of whole blood as the reference blood lead level for adults. In 2009, the Adult Blood Lead Epidemiology and Surveillance (ABLES) program updated its case definition for an EBLL to greater than or equal to 10 mcg/dL. The U.S. Department of Health and Human Services recommends that EBLLs among all adults be reduced to less than 10 mcg/dL. OSHA Lead Standards require workers to be removed from lead exposure when EBLLs are equal or greater than 50 mcg/dL (construction industry) or 60 mcg/dL (general industry) and allow workers to return to work when the EBLL is below 40 mcg/dL. OSHA Lead Standards also give the examining physician broad flexibility to tailor special protective procedures to the needs of individual employees. Therefore, the most current guidelines for management of lead-exposed adults should be implemented by the medical community at the current CDC/NIOSH reference EBLL of 10 mcg/dL.

Chart 5 shows that 2,086 adults in New Hampshire were tested for EBLL in 2013, resulting in 201 with EBLL over 10 mcg/dL, the level at which CDC/NIOSH recommends all adults be below. A total of six adults statewide tested above the OSHA standard of 40 mcg/dL. Adult blood lead surveillance data is not yet available for 2014.

Chart 5 – Historical overview of adult EBLL, 2010 – 2013



PRIMARY PREVENTION – KEEPING LEAD EXPOSURES FROM HAPPENING

Removing Lead Hazards from our Housing

Through private monies and funding from the U.S. Department of Housing and Urban Development (HUD) awarded to the Cities of Nashua and Manchester and to the New Hampshire Housing Finance Authority's Lead-Based Paint Hazard Control Programs, approximately 1,300 units housing low-income families have had lead hazards removed. According to the 2010 U.S. Census, over 300,000 units statewide may contain lead hazards. An estimated 18,000 of these units house young children under the age of six living in one of New Hampshire's 133 universal "high risk" communities. 2,478 of these homes house low income families with children six and under (Chiahui Chawla, 2014). Based on research conducted by Gould in 2009 the cost of lead abatement was in the range of $1,387 to $12,450 per housing unit (in 2013 dollars). To remove the lead hazards in these targeted 2,478 homes, would cost New Hampshire an estimated $3.8 to $34.3 million (Chiahui Chawla, 2014).

According to the US Census, over 300,000 units statewide may contain lead hazards.

The HHLPPP focuses grant funding received from the U.S. Environmental Protection Agency (EPA) on licensing lead professionals and building capacity and in the private sector to support the

removal of lead hazards in residential housing. In 2014, New Hampshire's licensed lead professionals included 3 Lead Inspectors, 17 Risk Assessors, 52 Lead Abatement Contractors, 5 Trainers, 14 Supervisors, and 72 Lead workers.

U.S. Environmental Protection Agency's Renovate, Repair, and Painting (RRP) Rule

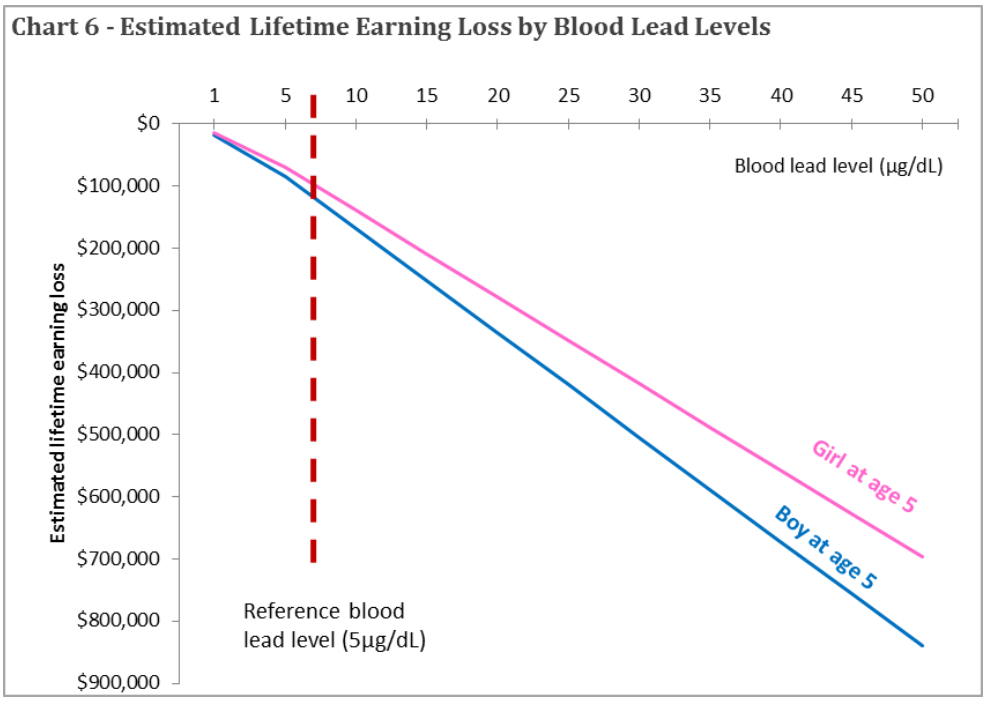
According to the Healthy Homes & Lead Poisoning Prevention Program surveillance data, over 1/3 of children with an EBLL over 10 mcg/dl live in a home with current renovations or one that had recent renovations. The EPA's Lead-Based Paint Renovation, Repair, and Painting (RRP) Rule, aims to protect the public from lead-based paint hazards associated with renovation, repair, and painting activities. Activities such as these create hazardous lead dust when surfaces with lead paint, even from many decades ago, are disturbed. The rule requires workers to be certified and trained in the use of lead-safe work practices, and requires renovation, repair, and painting firms to be EPA-certified. These requirements became fully effective April 22, 2010. Unfortunately, identifying those contractors performing such work in New Hampshire is difficult, as New Hampshire does not license contractors nor have a contractor registry. Currently, according to the U.S. Environmental Protection Agency, New Hampshire has 10,370 Renovators, 1,993 firms, and 5 RRP training providers that are trained and registered with the EPA.

ECONOMIC COSTS ASSOCIATED WITH EBLL

In 2014, the Division of Public Health, Environmental Public Health Tracking Program published a report, *Economic Burden of Environmentally Attributable Illness in Children of New Hampshire* that provided an overview of the costs associated with lead poisoning. Reducing lead exposure yields economic benefits by avoiding special education costs, preventing reductions in intelligence, academic achievement, future productivity, violent criminal behavior, and healthcare costs. The total cost associated with elevated blood lead in New Hampshire for 2013 is estimated to be $249 million.

…children in the 2013 cohort of 5-year olds would lose $240M potential earnings due to lead exposure.

According to the report, which uses CDC's National Health and Nutrition Examination Survey (NHANES) (2009-2010) which provides an estimate of the geometric mean blood lead level for U.S. children aged 1-5 years at 1.17 µg/dL , children in the 2013 cohort of 5-year-olds would lose $240.4 million potential earnings due to lead exposure. These costs should be interpreted as the lost value of future wage earnings that accrue over a lifetime. Therefore, they are not representative of direct annual expenditures, but are instead indicative of lost potential in the current cohort of 5-year-old children in New Hampshire.



Potential Lifetime Earning Loss Related to Lead Exposure

According to the *Economic Burden of Childhood Illness in New Hampshire* report a 1mcg/dl exposure to lead relates to a 0.57 decline in IQ points at 5 years of age with ranges from 0.2 to 0.93 IQ points. Applying a linear assumption between blood lead level increase and IQ point decrease, the report estimated lost lifetime earnings by blood lead level as illustrated in **Chart 6.** For example, a 5-year-old boy with a blood lead level at 50 mcg/dL may lose more than $0.8 million of his lifetime earnings. Total cost estimates for the economic impact of childhood lead exposure in New Hampshire were calculated. The present value of New Hampshire's economic losses attributable to lead exposure in the 2013 cohort of 5-year olds was estimated at $240.4 million with a range from $84.3 to $392.3 million.

Estimated Cost of Crime Related to Lead Exposure

There is a strong relationship between lead exposure during early childhood and future criminal activity, especially violent crime. Research has shown that childhood lead exposure affects the risk of criminal behavior later in life. Crimes included murder, rape, aggravated assault, robbery, and burglary. The *Economic Burden of Childhood Illness in New Hampshire* report shown that even a 1 mcg/dL reduction in the average preschool blood lead level may result in an estimated 889 fewer burglaries, 2 fewer robberies, 78 fewer aggravated assaults, 17 fewer rapes, and 1 fewer murders. The total direct cost of lead-linked crimes was estimated at $9 million, including direct victim costs, costs related to the criminal justice system, and productivity losses associated with perpetrators of

crimes. For the purposes of this conservative analysis, only the direct costs of each crime were considered.

Estimated cost of Medical treatment Associated With EBLL

In 2012, the CDC advised that an EBLL of 5 micrograms per deciliter (mcg/dl) be used as the reference level to identify children with an elevated BLL that should trigger additional action. The main intervention for an EBLL is to stop the exposure by removing environmental or dietary sources of lead. Actions for EBLLs (5-19 mcg/dL) involve follow-up monitoring and lead education for diet and environment. At higher lead levels (20-44 mcg/dL) children require further diagnostic lead testing, complete physical exams, neurodevelopment monitoring, and/or abdominal X-ray. Children with EBLLs 40 mcg/dL or above may need to be hospitalized and/or undergo chelation therapy according to HHLPPP guidelines. The *Economic Burden of Environmentally Attributable Illness in Children of New Hampshire* report applied Gould's study from 2009 and extended recommendation action to the new EBLL. The annual health treatment costs in New Hampshire were estimated at approximately $115,847 as shown in **Table 4**.

Table 4 - Estimated Annual Cost of Lead-related Medical Treatment in New Hampshire

Elevated Blood Lead Level mcg/dL	Estimated cost of medical action (in 2013$)	Number of children with EBLL (2014)	Estimated annual health cost (in 2013$)
5-14	$95.	233	$102,220
15-19	$95.	12	$1,235
≥20	$1,549.	9	$12,392
Estimated Total of Medical Treatment $115,847			

ADDITIONAL INFORMATION

This report is an overview of the 2014 program activities and blood lead surveillance data for the State of New Hampshire, Department of Health and Human Services, Division of Public Health Services, Healthy Homes and Lead Poisoning Prevention Program (HHLPPP). Please contact the program at 1-(800) 897-LEAD (5323) for further information regarding this report.

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