

Review of Blood Lead Screening Data

Treece, Kansas – September 2009

**Kansas Department of Health and Environment
Healthy Homes and Lead Hazard Prevention Program**

October 13, 2009



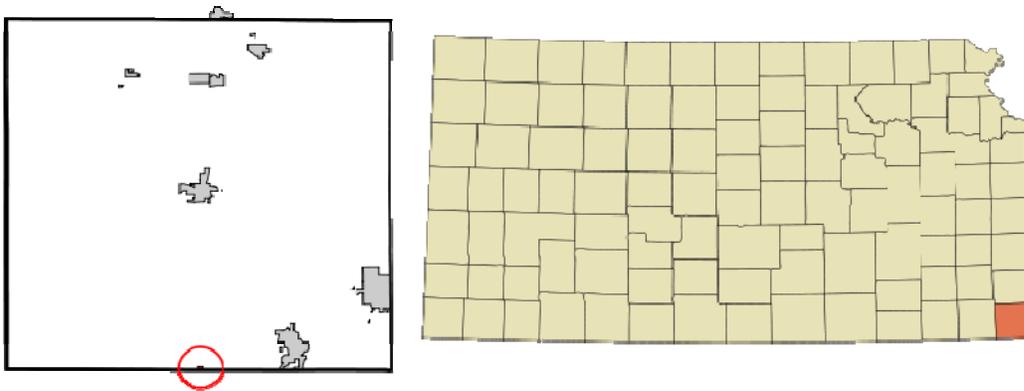
The results of a public health screening event that occurred in Treece, Kansas on September 8th and 9th, 2009 are reviewed and presented herein. The information presented is for informational use only and is not a determination or indicator of the overall public health of the community.

Background:

Treece, Kansas is located in Cherokee County in southeastern Kansas near the Kansas-Oklahoma state line. Treece is located in a geographic portion of Kansas where lead and zinc ore mining was once widespread. The mining activity in the area ceased during the 1970s. The remains of the mining activity are still present in the region and are the root of environmental concerns for the residents.

The 2008 population estimate for Treece is 139 individuals, down from 149 as recorded in the 2000 U.S. Census, recent press reports list the population as approximately 100 residents.

Location of Cherokee County & Treece Kansas



Cherokee County – Treece Kansas

Lead is a naturally occurring element with many historic uses. Lead is also a toxic heavy metal that affects multiple body systems, including the neurologic, hematologic, gastrointestinal, cardiovascular, and renal systems. The toxic effects of lead range from abdominal pain, loss of appetite, vomiting, and anemia to irritability, ataxia, stupor, coma, seizures, and death. Lead is a cumulative toxicant. When lead enters the blood stream it collects in soft tissues of the body and it also settles in the bones and teeth where it is stored for many years. Children are particularly vulnerable to the neurotoxic effects of lead because lead enters their brains and interferes with normal development. Even low levels of lead are associated with decreased intelligence, impaired neurobehavioral development, decreased stature and growth, and impaired hearing acuity. Pregnant women, developing fetuses, infants, and children are more vulnerable to lead exposure than adults since lead is more rapidly absorbed into growing bodies. In addition, children are more likely to be exposed to environmental sources because of their hand-to-mouth behavior and the higher absorption of ingested lead in the gastrointestinal tract. Children can also be exposed prenatally because lead crosses the placenta. Because of the special susceptibility of children, even relatively low levels of exposure can cause serious and in some cases irreversible neurologic damage, leading to permanent intellectual impairment.

In Kansas a child is deemed lead poisoned if they have a confirmed blood lead level (BLL) of 10 micrograms of lead per deciliter of blood or higher ($\geq 10\text{ug/dL}$), adults are deemed poisoned if they have a confirmed blood lead level of 25 micrograms of lead per deciliter of blood or higher ($\geq 25\text{ug/dL}$). The Kansas Department of Health and Environment (KDHE) asserts that there is no safe level of lead in the human body, however it is currently accepted that normal environmental lead exposures have resulted in a baseline BLL rate $\leq 2.5\text{ ug/dL}$ in the entire population of the state, which would be considered the norm.

KDHE actively seeks to prevent lead poisoning in Kansas. KDHE promotes the education of individuals and families statewide to enable them to learn about the dangers of environmental lead and how to prevent lead poisoning. In Kansas the greatest risk of exposure to environmental lead for children is from old lead-based paint found on homes. Environmental lead exposure for children and adults also occurs from other sources such as consumer products manufactured with lead as a component or painted with lead-based paints, through workplace exposures and through naturally occurring or manmade environmental exposures such as mine wastes and tailings.

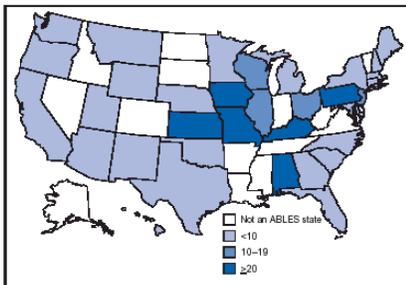
A vital component of the KDHE lead poisoning prevention efforts is the performance of blood lead screenings through local health departments, physicians and KDHE public health personnel. Blood lead screening allows for the determination of exposure and ingestion of environmental lead in individuals. KDHE tracks more than 30,000 blood lead screens annually in efforts to protect public health. Additional information about lead poisoning and the efforts of KDHE can be found at, www.kshealthyhomes.org.

Historically the majority of the KDHE lead poisoning prevention efforts have been directed toward developing children (categorized as being 6 years old or younger) as they suffer the greatest developmental harm when lead poisoned. KDHE has extensive historical blood lead data for children and limited blood lead data for adults.

Adults face the greatest risk of exposure to environmental lead through workplace exposure. Kansas is home to many industries that work with lead based products. Adults are generally screened by employers due to potential lead exposures related to their jobs as a requirement of the Occupational Safety and Health Act (OSHA). The KDHE collects and monitors the results of blood lead screens for adults. KDHE records indicate that the greatest numbers of adult blood lead screens in Kansas occur where industries such as battery manufacturing, metal working and aircraft manufacturing operate. There are very few adult blood lead screen results recorded for rural or unincorporated portions of the state. Nevertheless Kansas is recognized nationally as having a higher than normal prevalence of elevated blood lead (EBL) levels in adults (Figure 1).

Adult Blood Lead Levels in U.S.

FIGURE 1. Rate* of adult blood lead levels ≥ 25 $\mu\text{g}/\text{dL}$, by state — Adult Blood Lead Epidemiology and Surveillance program[†], United States, 2002



*Per 100,000 employed persons aged ≥ 16 years, according to the Bureau of Labor Statistics' Current Population Survey.

[†]Alabama, Arizona, California, Connecticut, Florida, Georgia, Hawaii, Illinois, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, Texas, Utah, Washington, Wisconsin, and Wyoming.

In April of 2009, KDHE increased efforts to screen and educate adults who are considered at risk for lead poisoning, however no significant historical data for adult blood lead levels in Treece, or Cherokee County, Kansas is available at this time.

The U.S Environmental Protection Agency (EPA), in response to congressional requests, sought to assess the exposure of Treece residents to environmental lead. On September 8th and September 9th, 2009, the KDHE, at the request of the EPA, assisted with a public health screening assessment to determine levels of lead in the blood of Treece residents.

Blood lead screening was conducted on a total of 73 residents of Treece, Kansas who reside in Zip Code 66778. An additional number of screens were performed on some individuals who did not reside in Treece; the results of those screens were not included in this review.

Methods:

Screening for blood lead levels requires the collection and analysis of a blood sample. There are three methods used for screening, a venous puncture blood draw, a capillary puncture and sample collection, and a finger stick blood droplet collection on an approved filter paper collection tool. The finger stick methodology is the least invasive and most cost effective method and is used extensively by the KDHE.

The population tested in Treece consisted of 73 individuals divided into 2 subsets. The first group is 57 individuals 7 years of age and older. The second group is 16 children age 6 and younger. KDHE divided the population into these two cohorts to more accurately compare relevant data since a larger amount of historical screening data is available for the 0 to 6 year old cohort.

The blood lead screening was accomplished using the finger stick protocol in which blood droplets are collected on a filter paper collection tool. The samples were analyzed by the KDHE laboratory using an inductively coupled plasma mass spectrometer (ICP-MS). The results of the screens

were analyzed and recorded by KDHE and then mailed to each individual screened. Any individual whose screening results indicate an elevated BLL that indicates possible lead poisoning is contacted by KDHE and local public health staff for follow up confirmatory testing and further confirmation of lead intoxication.

When KDHE receives information about any child who screens over 5.0 ug/dL the family is contacted and lead poisoning prevention information and education is provided, if a child tests at ≥ 10 ug/dL a second screen to confirm the BLL is scheduled. If the second screen also reflects the high BLL the child is considered lead poisoned and an environmental investigation is conducted. Case management activities commence to monitor the health of the individual at this time.

Screening results are not a positive determination of lead poisoning which requires further medical evaluation. As previously stated, in Kansas, the KDHE considers adults to be lead poisoned if they test conclusively for lead in the blood at a level of 25 micrograms per deciliter (ug/dL) or higher, children are considered lead poisoned if they test conclusively for lead in the blood at a level of 10 ug/dL or higher.

Lead poisoning prevalence rates are calculated by dividing the number of confirmed lead poisoning cases by the entire population tested. Blood lead testing is not mandatory for all children in Kansas however; the KDHE actively promotes screening state wide for children age 0 to 6. Information about national lead poisoning prevalence rates can be found on the Centers for Disease Control and Prevention (CDC) web site at www.cdc.gov/nceh/lead/data/index.htm.

Results:

The KDHE maintains historical blood lead data for children from 0 to 6 years of age but limited blood lead data for adults. The results examined have been divided into subsets for more relevant comparison.

The composite results of the screening are presented in tabular fashion and compare the current screening results within the community of Treece against historical data maintained by KDHE relating to blood lead levels in children 0 to 6 years old, for a period from January 1, 2005 through December 31, 2008. Additionally, the proportion of elevated screening results from the entire sample set of the Treece, Kansas community and state overall are compared.

Blood lead screening was conducted on a total of 73 residents of Treece, Kansas. This includes 57 individuals over 6 years of age and 16 children aged 6 and younger.

Blood Lead Levels of Treece, Kansas Residents > 6 Years of Age (N = 57), September 2009.

Table 1

	Median Blood Lead Level (ug/dL)
Male (n= 24)	4.0
Female (n=33)	4.0

Blood Lead Levels of Treece, Kansas Residents ≤ 6 Years of Age (N = 16), September 2009

Table 2

	Median Blood Lead Level (ug/dL)
Male (n= 8)	4.0
Female (n= 8)	4.0

The information presented in tables 1 and 2 above compares the median BLL of both subsets and also examines the results by gender. The median BLL is used because it is the most accurate measure of the midpoint for all the screen results. There is no significant difference between the age cohorts or the gender groups.

Blood Lead Levels of Treece, Kansas Residents by Age > 6 Years of Age (N = 57), September 2009.

Table 3

Blood Lead Level (ug/dL)	Number of Residents >6 Years
0 - 4.99 ug/dL	51
5 - 9.99 ug/dL	5
≥10 ug/dL	1

The information presented in table 3 examines the distribution of the BLL screening results for the individuals age 7 and over.

Blood Lead Levels of Treece, Kansas Residents by Age ≤ 6 Years of Age (N = 16), September 2009.

Table 4

Blood Lead Level (ug/dL)	Number of Residents ≤ 6 Years
0 - 4.99 ug/dL	13
5 - 9.99 ug/dL	2
≥ 10 ug/dL	1

The information presented in table 4 further compares the distribution of the screening results for the children 0-6 years of age.

Blood Lead Levels of Residents of Treece, Kansas by Year, ≤ 6 Years of Age.

Table 5

Blood Lead Level (ug/dL)	September 2009 (N = 16)	2005-2008 (N = 18)
0 - 4.99 ug/dL	13 (81%)	13 (72%)
5 - 9.99 ug/dL	2 (13%)	3 (17%)
≥ 10 ug/dL	1 (6%)	2 (11%)

The data presented in Table 5 compares the historical BLL of children 0-6 years old in Treece collected during 2005, 2006, 2007 and 2008 with the screening results from September 2009.

Blood Lead Levels (BLL) of Residents of Cherokee County, Kansas ≤ 6 Years of Age.

Table 6

	BLL 0 - 4.99 ug/dL	BLL 5 - 9.99 ug/dL	BLL ≥ 10 ug/dL
2005 (N = 290)	255 (88%)	55 (19%)	10 (3%)
2006 (N = 297)	235 (79%)	44 (15%)	18 (6%)
2007 (N = 365)	307 (84%)	47 (13%)	11 (3%)
2008 (N = 284)	245 (86%)	31 (11%)	8 (3%)
September 2009 (N = 16)	13 (81%)	2 (13%)	1 (6%)

Table 6 examines the BLL levels of children 0-6 years of age in Cherokee County, Kansas. Historically 3% of the children screened in Cherokee County have a BLL ≥ 10 ug/dL.

**Proportion of Elevated Blood Lead Levels (≥ 10 ug/dL) in Residents of Cherokee County
 ≤ 6 Years of Age.**

Table 7

Year	Number of BLL Screens	Number ≥ 10 ug/dL	Proportion (%)
2005	290	10	3.4
2006	297	18	6.1
2007	365	11	3.0
2008	284	8	2.8

Table 7 compares the proportion of the occurrence of a BLL ≥ 10 ug/dL in Cherokee County.

Proportion of Elevated Blood Lead Levels (≥ 10 ug/dL) in Children ≤ 6 Years of Age of Treece, Kansas

Table 8

Year	Number of BLL Screens	Number ≥ 10 ug/dL	Proportion (%)
2005-2008	18	2	11.1
September 2009	16	1	6.3
Total of Treece Screens	34	3	8.8

The data presented in Table 8 examines the proportion of screens in the ≥ 10 ug/dL range for children living in Treece.

**Proportion of Elevated Blood Lead Levels (≥ 10 ug/dL) in Kansas Residents
 ≤ 6 Years of Age.**

Table 9

Year	Number of BLL Screens	Number ≥ 10 ug/dL	Proportion (%)
2005	33,584	1,265	3.8
2006	32,001	1,034	3.2
2007	34,584	848	2.5
2008	36,230	795	2.2
Total Screens	136,399	3942	2.9

Table 9 presents the screening results for the entire state of Kansas for children aged 0-6 years for a similar historical period as reviewed for the Treece data.

Proportion of Elevated Blood Lead Levels (≥ 10 ug/dL) in Children ≤ 6 years of Age, 2005-2008.

Table 10

	Number of BLL Screens	Number ≥ 10 ug/dL	Proportion (%)
State of Kansas	136,399	3942	2.9
Cherokee County	1,252	48	3.8
Treece*	34	3	8.8

The comparisons reviewed in Table 10 BLL ≥ 10 ug/dL in children 0-6 years of age in the populations of the state, Cherokee County and Treece. *(Note: the total number of 34 BLL screens includes the BLL screens performed during September 2009 – the state totals and Cherokee County totals do not reflect 2009 screening data to date).

Discussion:

This study presents the results of the screening of Treece, Kansas residents for potential elevated BLLs. This review is not a complete evaluation of environmental health risks posed by lead in Treece, Kansas. ***Screening results are not a positive determination of lead poisoning which requires further medical evaluation.*** If a person initially screens with a BLL that indicates possible lead poisoning a follow up test to confirm the findings is required by KDHE. If a person is confirmed as lead poisoned KDHE Environmental Health personnel will perform an extensive health review and environmental investigation to determine the contributing factors in the lead poisoning case and will seek to assist the individual or family in eliminating the ingestion and exposure.

Lead poisoning in Kansas children most often occurs due to exposure to deteriorating lead-based paint in homes; and lead poisoning in Kansas adults is most often connected to workplace exposures.

There are at least two limitations to this study. First this study lacks data to compare the cohort of residents over age 6 and does not allow for appropriate comparisons or sound conclusions to be drawn concerning lead poisoning for the Treece residents 7 years of age and older.

Second, the sample size of Treece residents is small, which is a limiting factor in this review. In any study with a small sample one test result that is higher than the norm may skew the results.

While the number of screens performed in Treece is small (73 total / 57 people over age 7 / 16 children 6 years old and younger) the percent of the total population of Treece tested is significantly large (73/139=53%) when compared to data obtained from other community wide sampling events periodically held within the state. (Note: There is no recorded event of this type where more than 50% of an entire community’s population has been tested). The sample size of the 0-6 age cohort (16) is also not considered a limiting factor as the September 2009 screening event allowed for the testing of nearly as many children that had been previously tested during the 2005-2008 comparison period (18). This is considered relevant since the population of Treece has been static or in decline since the 2000 U.S.

Census. In this study it could be concluded that at least 50% of the children of Treece were screened. If 16 children is approximately 50% of the 0-6 year old population of Treece, Kansas, and the population of Treece, Kansas has remained stable since 2000, then we can conclude that we are comparing 50% of the current children of Treece, Kansas aged 0-6 to a random sample of 50% of the children of Treece, Kansas as drawn between 2005 and 2008.

The distribution of BLLs is constant over the studied date range. The 2009 screens do not show any significant variance from the previously collected samples suggesting that the exposure to environmental lead hazards in Treece, Kansas have not changed for at least the past four years.

The review of the data indicates that the residents of Treece, Kansas are consistently exposed to environmental lead hazards as evidenced. Treece, Kansas residents median BLL's of 4.0 ug/dL is higher when compared to the statewide norm of 2.5 ug/dL.

Blood lead screening data indicates that Treece residents face similar risks of environmental lead exposure regardless of age or gender. However, a single specific source of the exposure cannot be identified without further investigation. Historical lead poisoning prevention activities and data indicate that children aged 0-6 years are most likely to be exposed to lead at higher levels due to time spent crawling or playing on the floor or ground where lead dust is present and is ingested due to increased hand to mouth activities.

Residents over 6 years old in this study included adults (age 16 and over). Adults are considered lead poisoned when they have a confirmed BLL of 25 ug/dL or higher. When adults in Kansas screen at 10 ug/dL or higher KDHE provides lead poisoning prevention information and education to the individual. Based upon the information presented in this study, KDHE expects that one individual in Treece, Kansas will be contacted.

Children of Treece, Kansas aged 0-6 years are more likely to screen with a BLL \geq 10ug/dL than other children in the same age group in Cherokee County and the state as a whole. Based upon the information presented KDHE will contact one family to have a child screened a second time to confirm a BLL \geq 10 ug/dL.

The results of the September 2009 Treece, Kansas screening show 6.3% of the residents aged 0-6 years tested \geq 10ug/dL which is higher than the rate of 3.8% for Cherokee County overall (47/1236).

When comparing the proportion of children aged 0-6 years statewide that screened \geq 10 ug/dL (2.9%) between 2005 to 2008 with the total of the children aged 0-6 from Treece, Kansas screened from 2005 through the September 2009 screening with a BLL of \geq 10 ug/dL (8.8%) a dramatic difference is noted.

Although Treece, Kansas residents have a higher median BLL (4 ug/dL) when compared to the entire state (2.5 ug/dL), the Treece, Kansas results are from an initial BLL screening only. Additional environmental investigation and patient testing are needed to confirm actual lead poisoning cases. KDHE conducts testing and investigates any confirmed BLL screen in children in Kansas and will continue

lead poisoning prevention efforts in Cherokee County to protect the health and environment of residents through the promotion of informed responsible choice.