Master of Public Health

Integrative Learning Experience Report

Childhood lead exposure: a public health nutrition perspective

by

Amber Davis

MPH Candidate

submitted in partial fulfillment of the requirements for the degree

MASTER OF PUBLIC HEALTH

Graduate Committee:
Mark Haub, PhD, Major Professor
Ellyn Mulcahy, PhD, MPH
Priscilla Brenes, PhD, MPH

Public Health Agency Site:
Wilson County Health Department
Fredonia, Kansas
2021 to Present

Site Preceptor:
Amy Lell, Administrator

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2026

Table of Contents

List of Figures

List of Tables

Products

Summary/Abstract

This Integrated Learning Experience focuses on childhood lead exposure in a rural community from a public health nutrition perspective. The project was completed at the Wilson County Health Department in Fredonia, Kansas, where limited resources, older housing, and barriers to care contribute to ongoing risk of lead exposure among children.

The purpose of this project was to better understand how environmental and nutritional factors interact to influence lead exposure and to identify opportunities for improved prevention and education. A systems thinking approach was used to examine the relationships between housing conditions, access to screening, community awareness, and nutritional status. Special attention was given to the role of iron deficiency and calcium intake in lead absorption.

Local data from 2025 was analyzed to identify patterns in blood lead levels and associated risk factors. Findings showed that a portion of children screened had elevated blood lead levels, with the highest levels occurring in younger children and those living in older housing with low hemoglobin. Additional analysis demonstrated an association between higher blood lead levels and lower hemoglobin values, suggesting increased risk for lead absorption due to anemia.

Based on these findings, improvements were made to enhance community education and prevention efforts. Through this project I identified gaps in existing educational materials, particularly the lack of nutrition-focused guidance, and incorporated additional information to better support families. I also utilized programs such as Women, Infants and Children (WIC) as key intervention tools to improve nutritional status. In addition, I completed and submitted a grant application through Vitamin Angels to increase access to prenatal vitamins for women in the community, which resulted in the provision of vitamins to support women of childbearing

age, including pregnant and postpartum mothers. These efforts support improved nutritional status and may help reduce susceptibility to blood-lead absorption.

This project demonstrates the importance of integrating environmental health and nutrition in addressing lead exposure in rural communities. By applying systems thinking, this work contributed to a more comprehensive understanding of risk and supported the development of more effective, community focused prevention strategies.

Subject Keywords: Childhood lead exposure, public health nutrition, rural health, vitamin supplementation, iron deficiency, lead screening

Chapter 1 - Literature Review

Childhood lead exposure: environmental and nutritional influences blood-lead levels and their association with iron deficiency and anemia in children, by Disalvo et al. (2025), highlight the relationship between lead exposure and nutritional status. The authors reported that children with elevated blood lead levels, particularly those above 5 µg/dL, blood lead levels were more likely to exhibit iron deficiency and lower hemoglobin levels compared to children with lower lead levels. These findings emphasize the importance of considering both environmental and nutritional factors when addressing lead exposure in pediatric populations.

Childhood lead exposure remains a persistent public health concern despite decades of prevention efforts. Lead is a well-established neurotoxin, and no safe level of exposure has been identified for children (Centers for Disease Control and Prevention, 2024). Even blood lead levels below the current CDC reference value of 3.5 µg/dL have been associated with decreased cognitive function, behavioral issues, and long-term developmental delays (Centers for Disease Control and Prevention, 2024). Young children are particularly vulnerable due to increased absorption rates and frequent hand-to-mouth behaviors that increase exposure risk.

The primary sources of lead exposure in children continue to be environmental. These include deteriorating lead-based paint in homes built before 1978, contaminated soil, and aging infrastructure (Centers for Disease Control and Prevention, 2024). Additional contributing factors associated with lead exposure include exposure during home repairs and behaviors such as pica, both of which are recognized risk factors in children across the United States and are commonly identified in public health screening guidelines (Kansas Department of Health and Environment, 2023). Children living in older housing are at higher risk, particularly in communities where housing conditions are not well maintained. Socioeconomic factors also play

a role, as families with limited resources may have fewer options for safe housing and reduced access to preventive services.

In addition to environmental exposure, nutritional status is an important but often overlooked factor in lead toxicity. Research has shown that iron deficiency increases gastrointestinal absorption of lead, resulting in higher blood lead levels. This is particularly important in children who have increased iron needs to support rapid growth and development, including oxygen transport and cognitive function. When iron stores are low, the body absorbs more lead through shared transport pathways, increasing susceptibility toxicity.

Calcium also plays a protective role, as adequate intake can reduce lead absorption by competing for the same transport pathways in the body. In children, calcium is essential for bone development and growth, and inadequate intake may increase both lead absorption and retention in bone tissue.

Other trace minerals, including zinc and copper, have also been shown to influence lead absorption and toxicity, as deficiencies in these nutrients may increase susceptibility to lead exposure. These findings emphasize the importance of addressing overall nutrition status, including both macronutrients and trace minerals, as part of a comprehensive lead prevention strategy, particularly in populations at risk for both nutrient deficiencies and experimental exposure.

The relationship between lead exposure and anemia is particularly concerning in children, as both conditions can negatively impact growth and development. Lower hemoglobin levels reduce oxygen carrying capacity, which can further compound the effects of lead toxicity on cognitive and physical outcomes. This interaction demonstrates the need for integrated approaches that address both exposure and underlying nutritional status.

Wilson County, Kansas is a rural community with a population of approximately 8,000 residents. The county faces several structural challenges that contribute to increased risk of lead exposure, including higher rates of poverty and limited access to resources. Approximately 17.8% of the population lives below the poverty level, which is higher than the state of Kansas average at 13.7% (United States Census Bureau, 2023). Many homes in the area were built prior to 1978, increasing the likelihood of exposure to lead-based paint and environmental contamination.

In addition, Wilson County is considered a food desert, with limited access to grocery stores and nutrient dense foods. This contributes to the risk of nutrient deficiencies, particularly iron deficiency, which can increase lead absorption in children. These combined factors highlight how environmental conditions, socioeconomic status, and nutritional access interact to influence lead exposure risk within this community. These factors create a complex system in which environmental conditions and nutritional status interact to influence outcomes, supporting the use of systems thinking approaches in addressing this issue.

Chapter 2 - Learning Objectives, Project Description, Methods

The primary objective of this project was to better understand childhood lead exposure in a rural community using a public health nutrition and systems thinking approach. Specific learning objectives included:

- Identify environmental and nutritional risk factors associated with lead exposure
- Analyze local blood lead level data to identify trends and risk patterns
- Understand the role of iron deficiency and nutrition in lead absorption
- Apply systems thinking tools to a real-world public health issue
- Develop and improve educational materials for community use
- Strengthening communication of public health information to families

Project Description

This project was completed at the Wilson County Health Department in Fredonia, Kansas. The focus of the project was to assess childhood lead exposure within the community and identify opportunities to improve prevention and education efforts.

The project incorporated a systems thinking approach to better understand how environmental exposure, access to screening, community awareness, and nutritional status interact to influence lead exposure risk. A causal loop diagram (Figure 1) was developed to visualize these relationships and identify both reinforcing and balancing factors within the system.

Methods

Local data from 2025 was reviewed to identify patterns in blood lead levels and associated risk factors. Data collection included the use of the Kansas Department of Health and Environment lead risk-assessment questionnaire to identify children who required testing (Kansas Department of Health and Environment, 2023). This questionnaire assesses risk factors such as living in homes build before 1978, exposure to renovation, contact with lead related occupations, and use of imported products. Children with a “yes” or “don’t know” response to any question were tested immediately using capillary blood lead testing.

For those with elevated results, confirmatory venous testing was completed in accordance with KDHE guidelines by making a referral to the child’s pediatrician, who then ordered a blood draw/lab (Kansas Department of Health and Environment, 2023). The investigation process also included reviewing potential exposure sources, providing education to families, and conducting follow-up as needed.

The data gathered in my testing included examining the relationship between blood lead levels and hemoglobin values, which demonstrated a pattern of lower hemoglobin levels in children with higher lead exposure.

Diagrams

Causal loop diagrams and process flow

Poverty & Environmental Exposure Cycle

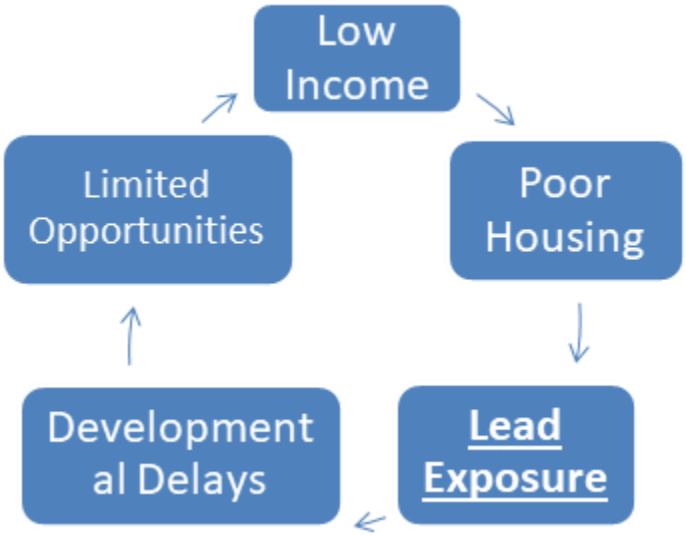


Figure 1 : Poverty & Environmental Exposure Cycle

Nutrition & Lead Absorption Cycle

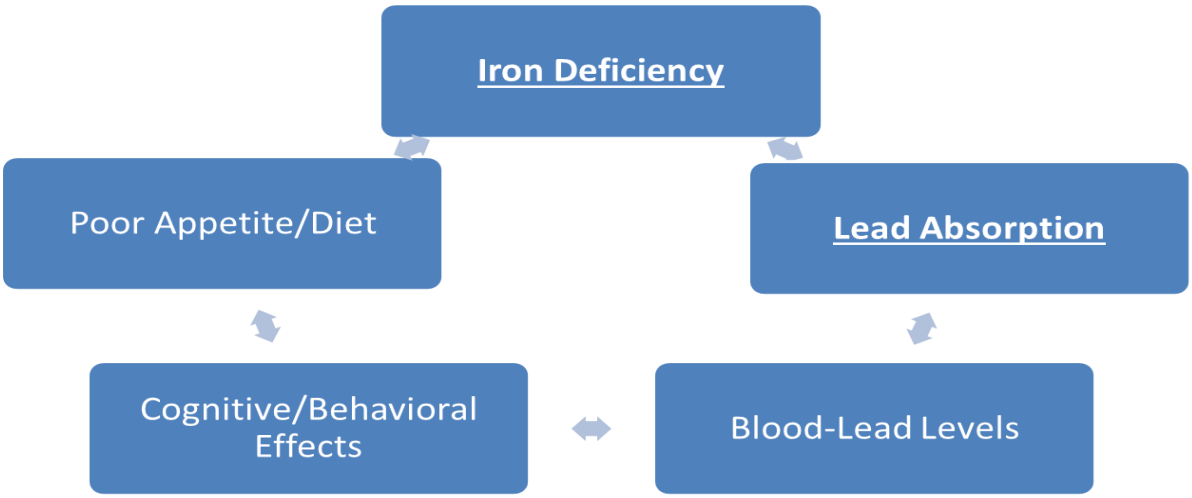


Figure 2: Nutrition & Lead Absorption Cycle

My Public Health Intervention – Women, Infants and Children (WIC) & Nutrition Education

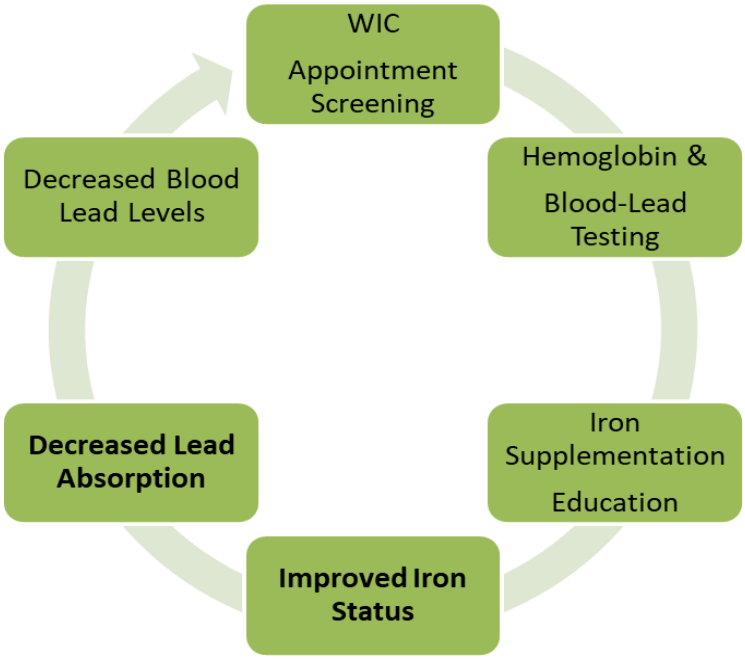


Figure 3: My Public Health Intervention – Women, Infants and Children (WIC) & Nutrition Education

Figure 4: Lead Risk Questionnaire

Lead Risk Questionnaire

Purpose: To identify children who need to be tested for lead exposure

Instructions:

- If Yes or Don't Know, test the child immediately
- For more information, contact your county's local health department

Patient's Name: _____ DOB: _____ Medicaid #: _____

Provider's Name: _____ Administered by: _____ Date _____

Questions:

	Yes or Don't Know	No
1. Does your child live in or visit a home, day-care or other building built before 1978?	☐	☐
2. Does your child live in or visit a home, day-care or other building with ongoing repairs or remodeling?	☐	☐
3. Does your child eat or chew on non-food things like paint chips or dirt?	☐	☐
4. Does your child have a family member or friend who has or did have an elevated blood lead level?	☐	☐
5. Is your child a newly arrived refugee or foreign adoptee?	☐	☐
6. Does your child come in contact with an adult whose job or hobby involves lead exposure?		

Examples

• House construction or repair	☐ • Chemical preparation	☐ • Radiator repair	☐
• Battery manufacturing or repair	☐ • Valve and pipe fittings	☐ • Pottery making	☐
• Burning lead-painted wood	☐ • Brass/copper foundry	☐ • Lead smelting	☐
• Automotive repair shop or junk yard	☐ • Refinishing furniture	☐ • Welding	☐
• Going to a firing range or reloading bullets	☐ • Making fishing weights	☐ • Other _____	☐

7. Does your family use products from other countries such as pottery, health remedies, spices, or food?	☐	☐

Examples

- Traditional medicines such as Ayurvedic, greta, azarcón, alarcón, alkohl, bali goli, coral, ghasard, liga, pay-loo-ah, and rueda
- Cosmetics such as kohl, surma, and sindor
- Imported or glazed pottery, imported candy, and imported nutritional pills other than vitamins.
- Foods canned or packaged outside the U.S.

Test Immediately

**** Elevated blood lead level is ≥3.5 µg/dL***

Table 1 APE Learning Objectives

Learning Objective	Activity Completed
Identify environmental and nutritional risk factors associated with lead exposure	Conducted lead risk assessments and reviewed screening data, and identified environmental and nutritional risk factors
Analyze local blood lead data to identify trends and risk patterns	Evaluated the 2025 blood lead levels and hemoglobin values and incorporate nutrition focused interpretation
Understand the role of iron deficiency and nutrition in lead absorption	Examine the relationship between blood lead levels and hemoglobin values and incorporate nutrition focused intervention
Apply systems thinking tools to a real-world public health issue	Developed causal loop diagram (Figure 1) and lead screening and follow up process flow diagram (Figure 4).
Develop and improve education materials for community use	Identified gaps in existing materials and developed additional education resources incorporating nutrition
Strengthen communication of public health information to families	Developed and presented a lead exposure presentation and created materials to support family education

As outlined in Table 2.1, learning objectives were achieved through a combination of structured data collection, analysis, and application of systems thinking tools. Data collection included the use of the Kansas Department of Health and Environment lead risk assessment questionnaire to identify children requiring testing, followed by capillary blood lead testing and

confirmatory venous testing for elevated results (Kansas Department of Health and Environment, 2023). Data analysis involved reviewing the 2025 blood lead levels and corresponding hemoglobin values to identify trends and potential associations.

System thinking methods included the development of a causal loop diagram (Figure 1) and lead screening and follow up process (Figure 4) flow to better understand how environmental exposure, nutrition, and access to care interact. In addition, program evaluation methods were used to assess existing educational materials and identify gaps, which informed the development of improved resources and communication strategies for families.

Chapter 3 - Products and Results

This project resulted in both data driven findings and practical improvements to lead prevention and education efforts within the Wilson County Health Department.

Local data from 2025 was reviewed to assess blood lead levels among children in the community. This data was collected through the Wilson County Health Department and reported to the Kansas Department of Health and Environment as part of routine public health surveillance. Blood lead samples were obtained through capillary testing at the local level, with elevated results confirmed by venous testing. Once collected, results were reported to KDHE and entered the state surveillance system, where they become part of the publicly available dataset used for monitoring and intervention (Kansas Department of Health and Environment, 2023).

While the majority of children screened had blood lead levels within the normal range, a portion of children were identified with elevated levels. Approximately 22.5 percent of children screened had blood lead levels above 3.5 µg per dL, indicating that lead exposure remains an active concern in the community. (Forty were tested, in 2025, nine tested above 3.5 µg per dL.)

Analysis of individual cases also identified a pattern between elevated blood lead levels and lower hemoglobin values. The most significant case included a child with a blood lead level of 20.3 µg per dL and a hemoglobin level of 7.0 g per dL, indicating severe anemia. Several additional cases showed a similar trend, suggesting an association between lead exposure and increased risk of anemia.

Risk factor assessment identified older housing as a consistent environmental factor among children with elevated blood lead levels. These findings were based on responses from

the Kansas Department of Health and Environment blood lead risk assessment questionnaire, which includes questions related to housing age, renovation exposure, and potential contact with lead sources (Kansas Department of Health and Environment, 2023). Additional contributing factors identified through this assessment included exposure during home repairs and behaviors such as pica. These findings align with known sources of lead exposure and reinforce the importance of environmental assessment and education.

In addition to data analysis, this project resulted in improvements to community education and prevention strategies. Existing educational materials were reviewed to assess content, clarity, and relevance to the population served. This review identified gaps, particularly in addressing the role of nutrition in lead absorption and the lack of practical, easy to understand guidance for families. As a result, additional educational content was developed to provide clearer, more practical guidance for families, including information on iron and calcium intake.

Guidance was also informed by common questions and barriers observed during patient interactions in the clinic setting, allowing materials to be tailored to the needs of the community.

While formal pre-testing of the materials was not conducted, informal feedback was obtained through use in patient education and discussion, which supported improved understanding and engagement. As a result, the revised materials provided clear, more practical guidance for families, including information on iron and calcium intake and strategies to reduce lead exposure.

A systems thinking approach was applied through the development of a causal loop diagram (Figure 7) and a process flow diagram outlining lead screening and follow up

procedures (Figure 4). The causal loop diagram (Figure 7) visually demonstrated how factors such as environmental exposure, nutritional status, and access to care interact through reinforcing and balancing relationships that influence lead exposure risk. The process flow diagram mapped each step of the screening and follow up process (Figure 4), from risk assessment to confirmatory testing and case management, which helped identify gaps and inefficiencies in the current workflow.

These tools enhanced understanding of how multiple factors contribute to lead exposure and help identification of at-risk children, increased integration of nutrition education, and more consistent follow up with families.

Data Visualizations – Results from Elevated Tests

Blood lead levels among children in Wilson County, 2025

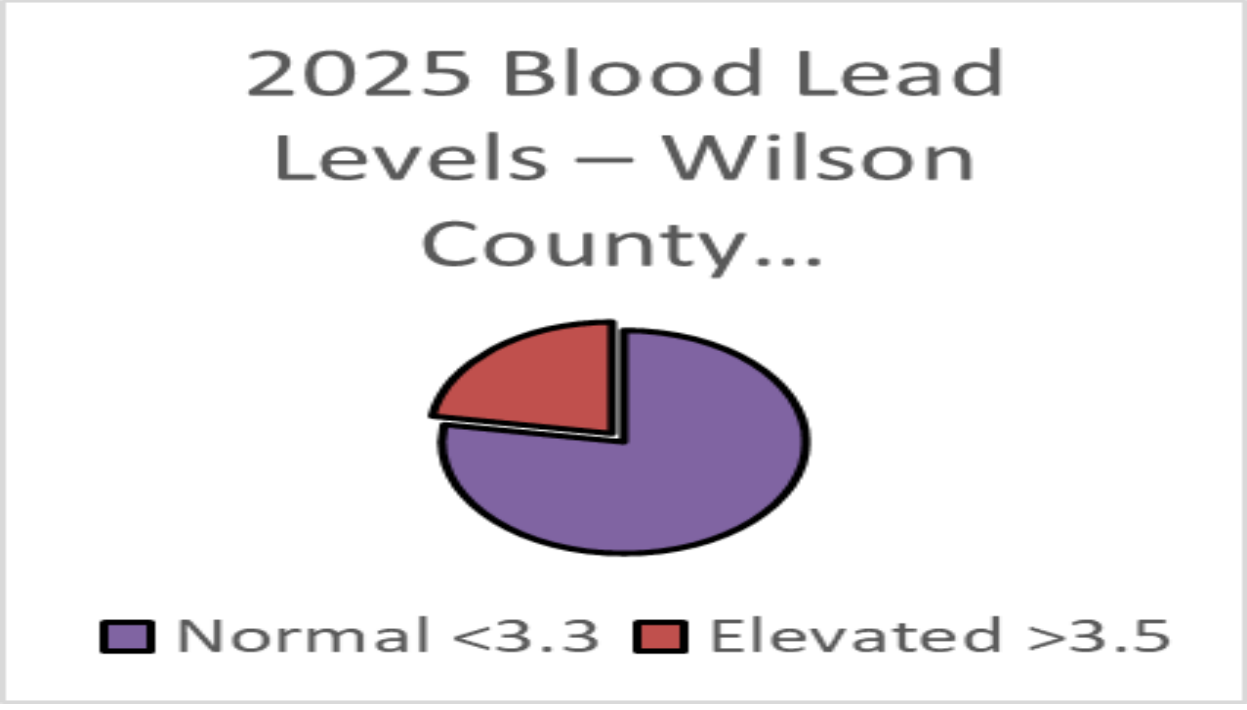
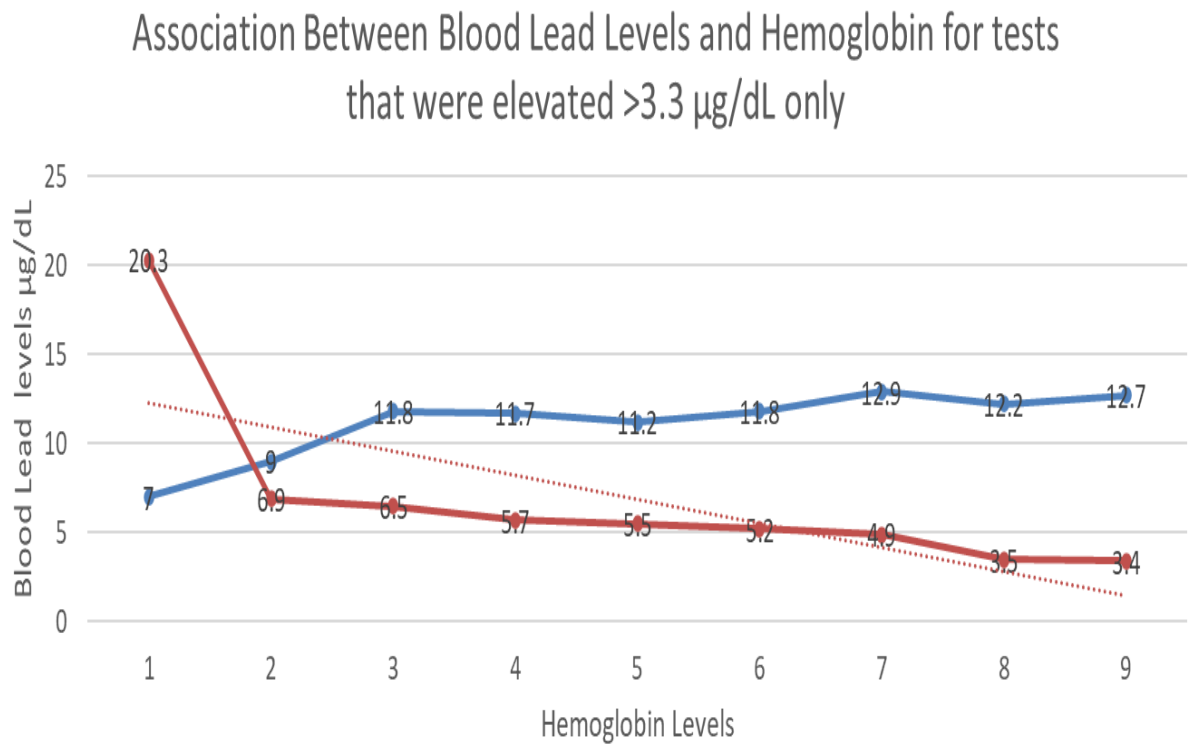


Figure 5: Blood lead levels among children in Wilson County, 2025

Association Between Blood Lead Levels and Hemoglobin for tests that were elevated >3.3 µg/dL (n=9)

Table 2 Blood lead level categories in Children



Category	Blood Lead Level (µg/dL)	Public Health Interpretation
Below reference level	< 3.5	Lower exposure, but no safe level established
Elevated	≥ 3.5	Requires follow up and intervention
Moderate	5–19	Increased risk, requires case management
High	≥ 20	Significant exposure requires urgent intervention

Reference levels Table 3

Table 4 Blood lead levels and hemoglobin values in children, 2025

Blood lead levels and hemoglobin values in children, 2025 tests that were elevated >3.5 µg/dL only (n=9)

Blood Lead (µg/dL)	Hemoglobin (g/dL)
5.2	11.8
6.9	9.0
20.3	7.0
3.4	12.7
5.5	11.2
6.5	11.2
3.5	11.8
4.9	12.9
5.7	11.7

The LeadCare II analyzer reports any blood lead value below 3.3 µg/dL as “low,” so specific numerical values are not available for results under this threshold. A compiled dataset was not available; therefore, this table reflects values taken directly from individual lab results (n = 40).

Table 5 Risk factors identified among children with elevated blood lead levels (n=9)

Risk Factor	Number of Children	Percentage (%)
Q1. Older housing (pre-1978)	9	100%
Q2. Home renovation exposure	4	44%
Q3. Pica behavior	4	44%
Q4. Family member with elevated Blood lead	4	44%
Q5. Refugee or Foreign adoptee	0	0%
Q6. Hobby Risks	6	67%
Q7. Foreign Product usage	0	0%

Causal loop diagram of childhood lead exposure

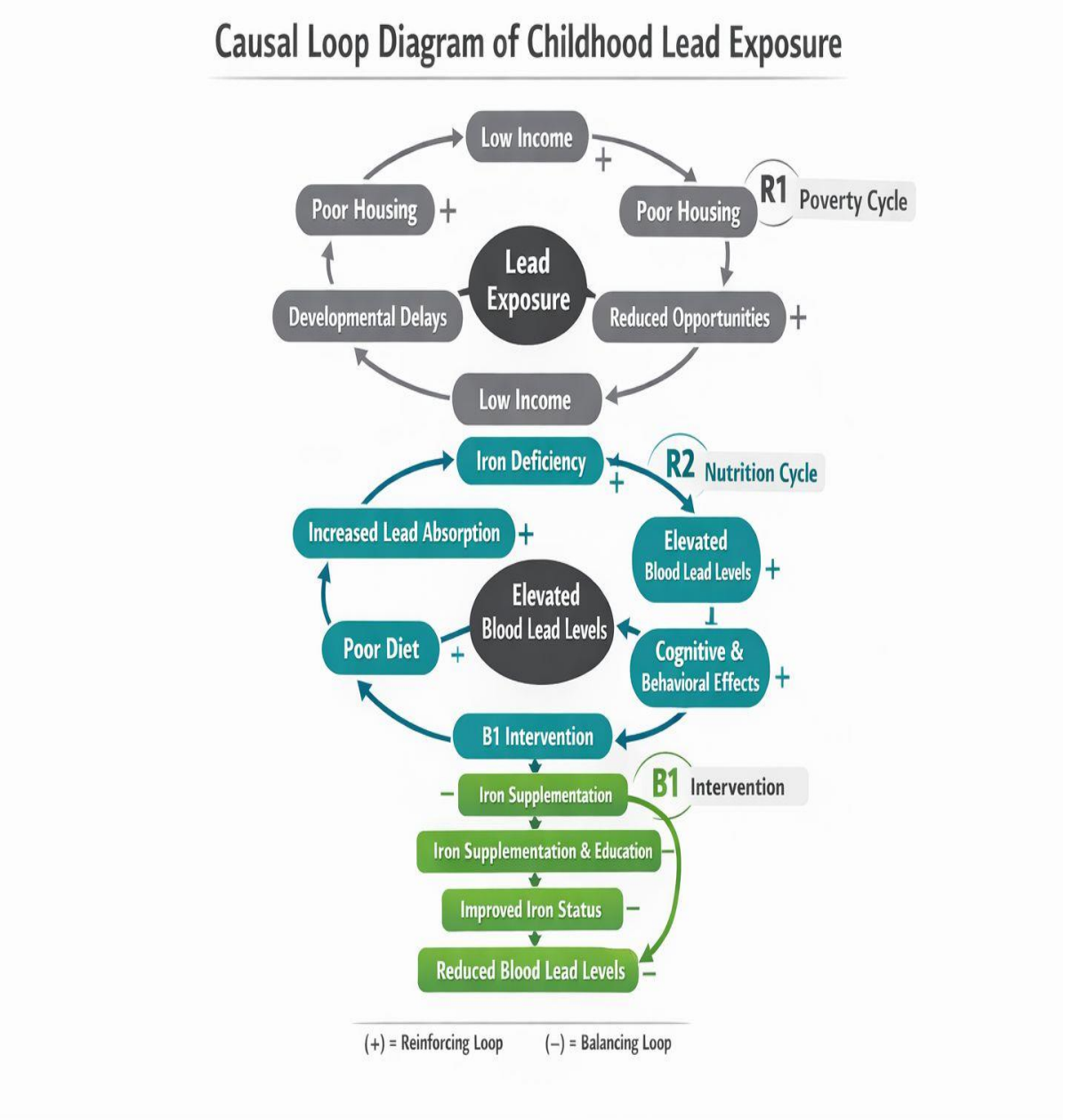


Figure 6: Causal loop diagram of childhood lead exposure

Products

These tools were developed to support a systems thinking approach to childhood lead exposure.

Products 1: Hemoglobin Levels in Children Brochure

The development of the hemoglobin education brochure was guided by the need to improve understanding of anemia and low hemoglobin levels among families served by the Wilson County Health Department. Existing materials were reviewed and found to lack clear, practical guidance for parents, particularly in explaining what hemoglobin levels mean and how nutrition impacts iron status. Resources used to develop the brochure included CDC guidance on anemia and iron deficiency, as well as evidence based literature on the role of iron in child growth and development.

To improve accessibility, the brochure was designed using plain language principles and evaluated for readability with the goal of maintaining an approximate 5th to 6th grade reading level. Visual elements, including color, layout, and images, were selected to support understanding without overwhelming the reader.

While accessibility principles were applied, the brochure does not fully meet all Section 508 requirements. Specifically, the document was not formally tested for screen reader compatibility, does not include alternative text for images, and may not meet all technical contrast ratio standards required for full compliance. These limitations reflect common challenges in developing printed and digital educational materials in a public health setting but identify areas for future improvement.

The brochure was informally reviewed through use in patient education and by public health staff including one Registered Dietician who provided feedback on clarity, usefulness, and relevance. (B. Stoneberger, RDN, personal communication, Jan, 2025) Based on this feedback, revisions were made to simplify wording, improve organization, and include more actionable guidance, such as iron rich food examples and when to follow up with a healthcare provider. These changes resulted in a more effective and user friendly resource for families.

What is hemoglobin?

Hemoglobin is a protein found in red blood cells. It carries oxygen from the lungs to the rest of the body. Oxygen is needed for your child's brain development, growth, energy, and overall health.

Why is hemoglobin important?

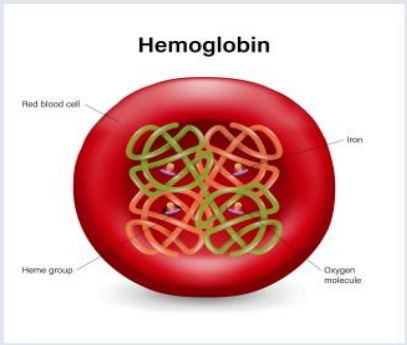
When hemoglobin is low, the body does not get enough oxygen. This can cause:

- Tiredness or low energy
- Pale skin
- Poor appetite
- Trouble with learning, attention, or behavior
- Slower growth and development

Low hemoglobin is often related to low iron levels, which is common in young children.

Follow-Up

- WIC will re-check hemoglobin at the next appointment if levels are 11.5 or lower
- Medical follow-up is important to confirm results and address your child's individual needs
- If you have questions, please contact the Wilson County Health Department or your child's healthcare provider.



Contact us

WILSON COUNTY HEALTH DEPARTMENT
421 N. 7TH
FREDONIA, KS 66736
620-378-4455 (PHONE)
620-378-4647 (FAX)
WLHEALTH@WILSONCOUNTYKANSAS.ORG

WCHD
Wilson County Health Department

Hemoglobin Levels in Children

Hemoglobin Levels in Children: What the Numbers Mean

_____12.0 or higher - Normal - Hemoglobin level is healthy for most children. Usually no symptoms. A child typically has normal energy, appetite, and growth.

_____11.6 – 11.9 - Low-Normal - Slightly low but not concerning at this time. Often no symptoms. May watch diet and iron intake.

_____11.0 – 11.5 - Mildly Low - Below the recommended range. Needs monitoring and follow-up. Mild tiredness, pale skin, picky eating, lower energy, may get sick more often.

_____10.0 – 10.9 - Moderately Low - More noticeable low hemoglobin. Medical follow-up is important. Fatigue, pale skin, poor appetite, irritability, slower growth, trouble concentrating.

_____8.0 – 9.9 - Low - Significant anemia. Needs prompt evaluation by a healthcare provider. Very tired, weak, shortness of breath with activity, pale lips or gums, fast heartbeat.

_____Below 8.0 - Very Low - Serious level. Requires urgent medical evaluation. Extreme fatigue, rapid breathing, fast heart rate, dizziness, poor appetite, and possible fainting.

When to Call Your Child's Healthcare Provider

You should contact your child's doctor if:

- Your child's hemoglobin is 10.9 or below
- Your child appears very tired, pale, or is not eating well
- You have concerns about iron intake or nutrition

Call your child's doctor's office to schedule an appointment to confirm this result and discuss next steps.

What to say?

You may use the script below when calling:
"Hello, I'm calling because my child was seen at the Wilson County Health Department during a WIC appointment. Their hemoglobin level tested at _____. I was advised to schedule an appointment to confirm this number and discuss my child's health and possible iron needs."

How to Help Raise Low Hemoglobin Levels

If recommended by your healthcare provider or our Registered Dietitian, hemoglobin levels may improve with:

Iron-Rich Foods

- Iron-fortified cereal
- Lean meats (beef, turkey, chicken)
- Eggs
- Beans and lentils
- Peanut butter
- Dark green vegetables (spinach, broccoli)

Vitamin C Helps Iron Absorption

Pair iron foods with:

- Oranges or orange juice
- Strawberries
- Tomatoes
- Bell peppers

Iron Supplements

- Only give iron supplements if prescribed by your child's healthcare provider
- Too much iron can be harmful

Products 2: Blood Lead Levels in Children Brochure

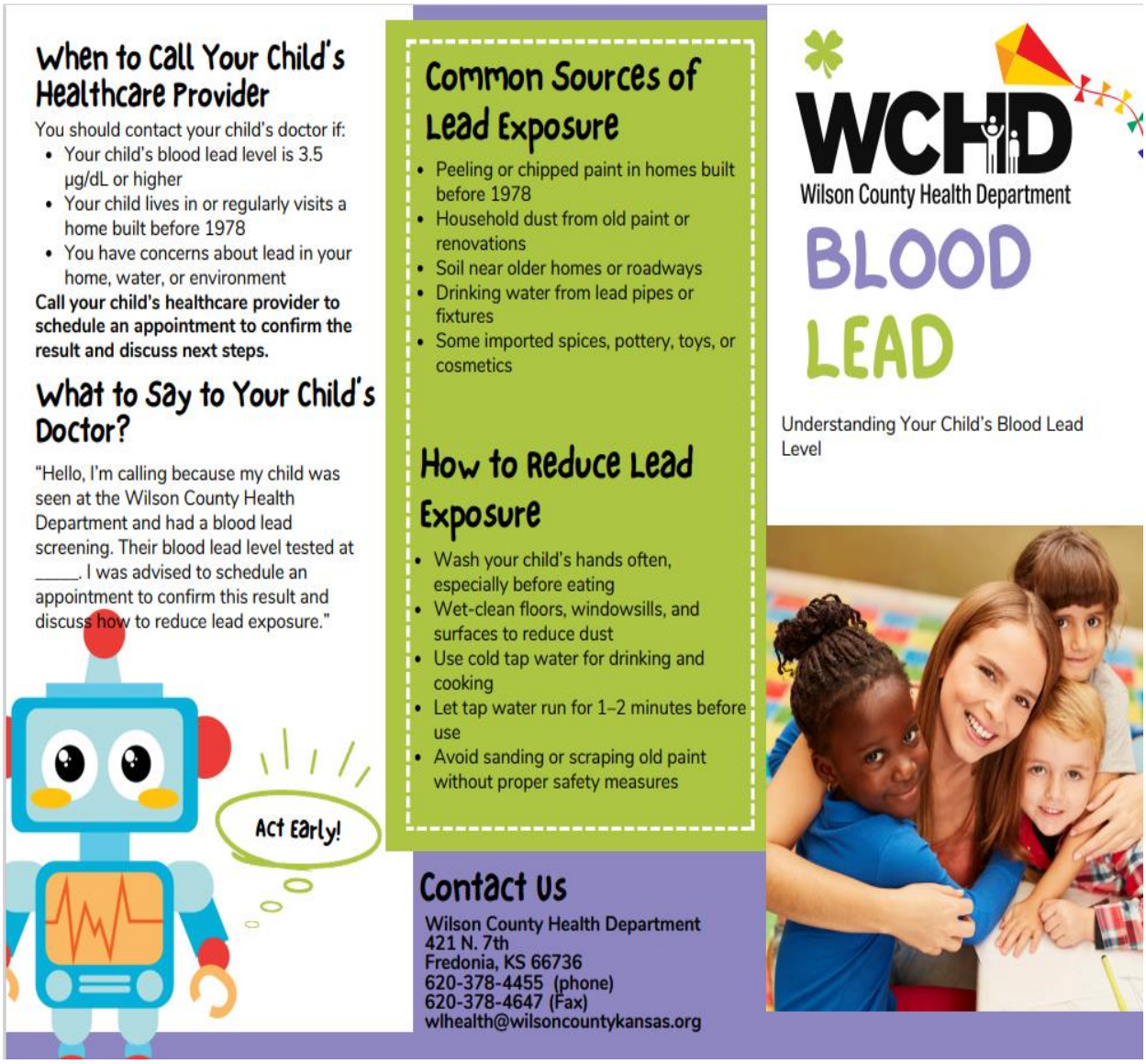
The development of the lead education brochure was guided by the need to address gaps identified in existing KDHE materials, particularly the lack of nutrition focused guidance and limited practical application for families. Resources used to develop the brochure included KDHE educational materials, CDC guidance on childhood lead exposure, and current literature on the role of iron and calcium in reducing lead absorption. Content was adapted to ensure it was relevant to the local population and aligned with public health recommendations. (Centers for Disease Control and Prevention, 2024) (Kansas Department of Health and Environment, 2023)

To improve accessibility, the brochure was designed using plain language principles and evaluated for readability using standard readability tools, with the goal of maintaining an approximate 5th to 6th grade reading level to ensure comprehension across a broad audience. Visual elements, including color choices, images, and layout, were selected to enhance clarity and engagement while avoiding overwhelming or technical presentation.

While full Section 508 compliance was not formally tested, accessibility principles were incorporated into the brochure design. This included the use of plain language, organized layout with clear headings, and visual elements to support understanding. High contrast color combinations and readable font sizes were selected to improve accessibility for individuals with varying literacy levels and visual abilities.

However, full digital accessibility requirements, such as screen reader compatibility and alternative text for images, were not formally implemented. Despite this, the design prioritized readability and usability for the target population in a community based public health setting.

The brochure was informally reviewed through use in patient education settings and by public health staff including one Registered Dietician, who provided feedback on clarity, usefulness, and relevance. (B. Stoneberger, RDN, personal communication, Jan, 2025) Based on this feedback, revisions were made to simplify language, improve organization, and include more practical guidance, such as specific nutrition recommendations and steps families can take to reduce exposure. These changes resulted in a more accessible and actionable resource for the community.



Your Child's Blood Lead Result

- Blood lead levels are measured in micrograms per deciliter (µg/dL).
- If your child's blood lead level is 3.5 µg/dL or higher, follow-up testing and guidance are recommended.
- This screening helps us monitor exposure, but it does not replace medical care
- **Most children with elevated levels do not look sick, which is why testing is important.**

Blood Lead Levels in Children: What the Numbers Mean

____Below 3.5 (CDC reference value). Low lead level, but no amount is completely safe. Continue prevention. Typically, no symptoms.

____3.5 – 4.9 - Elevated – Above recommended level. Repeat testing and prevent exposure. Often no symptoms, but it may affect learning or attention over time.

____5.0 – 9.9 - Moderately elevated – Concerning level. Medical follow-up and environmental investigation are recommended. May impact learning, behavior, attention, or cause irritability; often no clear symptoms.

____10 – 19.9 -High – Significant exposure. Prompt medical follow-up and immediate exposure reduction are needed. May cause developmental delays, learning difficulties, behavior changes, or stomach pain.

____20 – 44.9 - Very high – Serious exposure. Urgent medical and environmental intervention required. May cause fatigue, irritability, poor appetite, abdominal pain, headaches, or developmental regression.

____45 or higher - Extremely high – Medical emergency. Immediate treatment and possible hospitalization required. May cause vomiting, confusion, seizures, severe anemia, or lasting developmental harm.

What is lead?

Lead is a toxic metal that can be found in old paint, dust, soil, water, and some household items. There is no safe level of lead in the body, especially for children.

What is a blood lead test?

A blood lead test measures the amount of lead in your child's blood. This test helps identify exposure so steps can be taken to reduce future contact and protect your child's health.

Why is lead a concern for children? Most children with elevated levels do not look sick, which is why screening is important.

Lead affects the developing brain and nervous system. Even low levels can impact:

- Learning and attention
- Behavior and impulse control
- Growth and development
- Hearing and speech

Children are more vulnerable than adults because their bodies absorb lead more easily.

Products 3: Packet of information for Children with Elevated Blood Lead Levels

Packet of Info - Product 3

These flyers were developed to be included in the educational packet mailed to families following a positive blood lead screening to provide clear, practical guidance at a critical point of follow up. The purpose of creating these materials was to supplement existing KDHE information with more user friendly, actionable content, particularly related to identifying sources of exposure, prevention strategies, and the role of nutrition in reducing lead absorption. Content was developed using resources from the Kansas Department of Health and Environment and the Centers for Disease Control and Prevention to ensure accuracy and consistency with current public health recommendations, and was adapted to better meet the needs of the local population.

Readability was assessed using built-in readability statistics in Microsoft Word, including the Flesch-Kincaid Grade Level, with the goal of maintaining materials at approximately a 5th to 6th grade reading level. Plain language principles were also applied to improve clarity and comprehension for a broad audience. Readability was a key consideration in development, with materials written using plain language principles and structured with short sentences, bullet points, and visual cues to support understanding. Readability was evaluated informally with the goal of maintaining an approximate 5th to 6th grade reading level to ensure accessibility for a broad audience. Design elements, including color, icons, and images, were intentionally selected to enhance comprehension and engagement, while avoiding overwhelming or overly technical presentation.

The flyers were informally reviewed through use in patient education and by public health staff, including feedback from clinical and nutrition professionals, to assess clarity, usefulness, and relevance. Feedback indicated that families responded well to the visual layout and practical guidance, but recommended simplifying certain wording and emphasizing key action steps. Based on this input, revisions were made to improve organization, clarify messaging, and include more actionable examples, such as common sources of lead exposure and specific nutrition recommendations. These changes resulted in more effective educational materials that better support families following a positive lead test.

The inclusion of these materials in the follow up packet also supports improved communication and may increase the likelihood of families understanding recommendations and completing necessary follow up actions, such as confirmatory testing and environmental modifications.

Appendix B: Elevated Blood Lead Case Investigation and Management Algorithm

Blood Lead Test Result Value	Specimen Source Type	LHD to identify and recommend additional services	Timeline for LHD to recommend retesting	LHD Mail Lead Educational Packet	LHD Conduct Telephone Interview
≥3.5 µg/dL and < 5 µg/dL	Capillary	Yes	Follow-up with confirmatory venous test within 3 months if venous testing is available for accuracy purposes. If venous test is not available, within 90 days perform a follow-up capillary test.	No	No
≥ 3.5 µg/dL and < 5 µg/dL	Venous	Yes	Venous test again within 3 months to determine if lead levels are decreasing.	No	No
≥ 5 µg/dL and < 10 µg/dL	Capillary	Yes	Venous confirmatory test within 1 to 3 months. Urgency of confirmatory test is based on test result and the higher the test results the sooner another test needs to be performed.		
≥ 5 µg/dL and < 10 µg/dL	Venous	Yes	Perform follow-up venous test within 1 to 3 months	No	No
≥ 10 µg/dL and < 15 µg/dL	Capillary	Yes	LHD to call parents and physicians and recommend confirmatory venous test in 1 week to 1 month. Urgency of confirmatory test is based on test result and the higher the test results the sooner another test needs to be performed.		
≥ 10 µg/dL and < 15 µg/dL	Venous	Yes	Venous test within 1 to 3 months	Yes	Yes
≥ 15 µg/dL and < 24 µg/dL	Capillary	Immediate confirmatory venous test	LHD to call parents and physicians and recommend confirmatory venous test in 1 week to 1 month. Urgency for the confirmatory test is based on how high the test result is.		
≥ 15 µg/dL and < 24 µg/dL	Venous	Yes	Venous test within 1 to 3 months*	Yes	Yes
≥ 25 µg/dL and < 44 µg/dL	Capillary	Immediate confirmatory venous test	LHD to call parents and physicians and recommend confirmatory venous test in 1 week to 1 month. Urgency for the confirmatory test is based on how high the test result is.		
≥ 25 µg/dL and < 44 µg/dL	Venous	Yes	Venous test within two weeks to four weeks*	Yes	Yes
≥45 µg/dL	Capillary	Immediate confirmatory venous test	Contact the Poison Control Center (Mid-America Pediatric Environmental Health Specialty Unity) and notify KDHE immediately.		Confirmatory test should be performed before EBL investigation
>45 µg/dL	Venous	Yes	LHD to call parents and physicians and recommend confirmatory venous test within 48 hours if ≥45µg/dL and <60 µg/dL; 24 hours if ≥ 60 µg/dL and <70 µg/dL; immediately if ≥70 µg/dL.	Yes	Full EBL Investigation to determine exposure source(s)

The Kansas Department of Health and Environment is responsible for sending elevated blood lead level (EBL) notification letters to the parents or guardians of all children with elevated blood lead test results.

Retrieved from https://www.kdhe.ks.gov/DocumentCenter/View/40282/Appendix-B-EBL-Case-Investigation-Algorithm-PDF

Childhood LEAD POISONING PREVENTION

A PROGRAM OF THE KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT

Consider This

Children can get lead poisoning by breathing in or swallowing dust that contains lead. Even at low levels, lead can cause irreversible damage to hearing, growth and development.

Sources of Lead

Identify and remove sources of lead from your home.

Home

Lead can be in paint in homes built before 1978.

- Chipped paint
- Dirt
- Old furniture/toys
- Play/costume jewelry
- Pewter
- Crystal glassware

Imported Goods

Items from other countries may contain lead, even if purchased in the United States.

- Glazed pottery
- Asian, Hispanic, Indian spices
- Mexican candy (tamarindo and chili)

Home Remedies

Some home remedies may contain lead.

- Traditional and folk remedies (Greta, AzarcÓn, Pay-loo-ah)

Beauty Products

Imported beauty products from Asia, India, and Africa may contain lead.

- Sindoor, Khol, Kajal, Surma

Jobs

Jobs such as car repair, mining, construction and plumbing may expose you to lead. Lead dust from work can be brought into your home.

- Car batteries
- Scrap metal/parts
- Ammunition

Hobbies

Certain hobbies increase your risk of coming in contact with lead.

- Hunting (lead bullets, indoor firing ranges)
- Fishing (lead sinkers)
- Artist paints
- Refinished furniture

Travel

Traveling outside the U.S. may increase your risk of coming in contact with lead-based items.

- Souvenirs
- Spices or food
- Toys
- Jewelry

Cleaning

Keep lead dirt and dust out of your home with these helpful tips.

- Wash Hands
- Keep Shoes Outside
- Mop and Wet Wipe
- Vacuum with a HEPA Filter
- Wash Toys

Avoid sweeping, dry dusting and beating rugs

Nutrition

These foods can help lower your child's lead level.

Vitamin C

- Tomatoes
- Strawberries
- Oranges
- Potatoes

Calcium

- Milk
- Cheese
- Yogurt

Iron

- Steak
- Fish
- Peas
- Eggs

For more information, visit www.kdheks.gov/epi/CLPPP.htm.

Retrieved from https://www.kdhe.ks.gov/DocumentCenter/View/25214/Poster---Lead-Poisoning-Prevention-PDF

KEEP

HEAVY METALS

FROM WEIGHING YOU DOWN

Heavy metals (like lead, arsenic and cadmium) can build up in your body. This can lead to heavy metal poisoning and can make you sick. To reduce heavy metal poisoning, eat a variety of healthy foods. Healthy foods can also help remove metals if you have high levels of heavy metals already in your body.

Calcium and Vitamin D

- Milk
- Yogurt
- Cheeses

Protein, Iron and Zinc

- Lean meats, nuts and beans
- Eggs
- Soy and Tofu
- Yogurts, cheeses and milk

Vitamin C

- Sweet Bell Peppers
- Oranges and Grapefruits
- Broccoli
- Strawberries
- Melon
- Tomatoes

Fiber

- Nuts and nut butters
- Beans
- Pears, oranges and berries
- Peas and broccoli
- Whole grains and oatmeal
- Popcorn

Did You Know?

Your skin makes Vitamin D when the sun hits it. Vitamin D helps you absorb calcium, which can help prevent heavy metal poisoning.

KANSAS WIC

Childhood LEAD POISONING PREVENTION

A PROGRAM OF THE KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT

For more information, visit www.kdheks.gov.

Retrieved from https://www.kdhe.ks.gov/DocumentCenter/View/25215/Nutrition-Flyer---Dont-Let-Heavy-Metals-Weigh-You-Down-PDF?bidId=

GOT LEAD? DON'T PANIC!

MAPEHSU
MID-AMERICA PEDIATRIC ENVIRONMENTAL HEALTH SPECIALTY UNIT

If your home was built on or near heavy-metal mining or smelting waste, if your home was built before 1978 or you know or suspect that there is Lead-Based Paint (LBP) present in your home, this fact sheet is for you. Most of the time, LBP dust can be managed by good, regular cleaning. The following information provides some practical and safe ways to clean to protect you and your family. As you work through our recommendations, there are a few things to keep in mind:

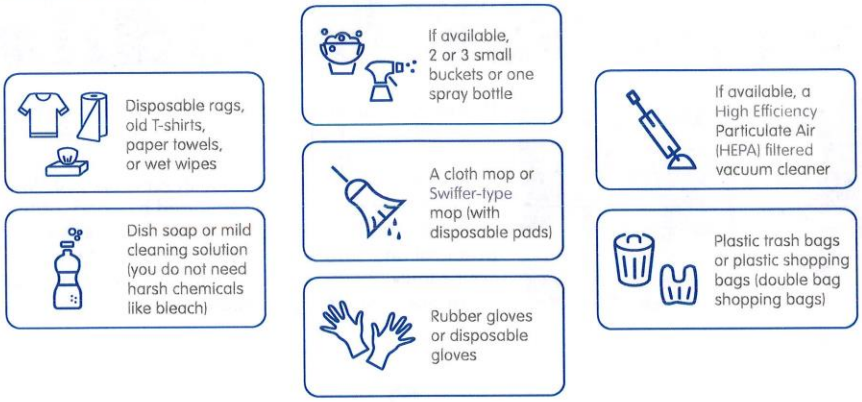
Dos & Don'ts

- ✓ Damp-dust and wet-mop **even where you don't see dust!**
- ✗ Do not clean by dry dusting, spraying cleaner right onto a surface, or sweeping.
- ✓ If possible, have a floor mat at your home's entrance (the door you use most often) AND remove your shoes at the door. This prevents bringing contaminated soil into the home.
- ✗ Do not open windows that have flaking paint.
- ✓ Always clean "Top to Bottom" – clean higher areas first and work your way down. Floors should be the last thing you clean.
- ✓ Wash your hands and under your nails with soap and water: 1) after cleaning, 2) after being outside, 3) before and after eating.
- ✓ Vacuum with a HEPA filter vacuum. When you vacuum, do so very slowly so that you pick up as much dust as possible. Vacuum first, mop second.

CLEANING RECOMMENDATIONS – WITH, WHAT, WHEN

WITH:	WHAT:	**WHEN** (this is a goal; do it when you can):
Dust and clean with warm soapy water	• Hard-surfaced toys, pacifiers, eating area, containers • Walls, doors, windowsills • Plastic or leather furniture	Weekly
Vacuum (use a HEPA filtered vacuum if available)	• Floors, carpeting, upholstered furniture (couch, chairs, beanbag chairs, etc. – use the vacuum hose)	At least weekly
Mop (Cloth-style or Swiffer-type with disposable pads)	• Hard-surfaced floors	At least weekly
 Remove OR put things you want to save in sealable plastic totes AND donate or trash items you no longer use	• Damaged or old toys, keepsakes, household items, etc. • Clutter	As needed
 Clean in a washing machine or sink	• Bedding (blankets, pillowcases) • Stuffed toys or animals	Weekly
	• Curtains • Pillows • Stuffed toys not used	Monthly

CLEANING RECOMMENDATIONS – WITH, WHAT, WHEN



HOW TO CLEAN EFFECTIVELY — TO REMOVE LEAD AND OTHER CONTAMINANTS

For hard surfaces like windowsills, door frames, wood trim, toys, etc.:	For carpeting and/or upholstered furniture:	For hard-surface floors:
1. If using rags (at least 2 per room), prepare spray bottle with soap and water OR fill bucket 1.) with soap and water and 2.) with clean water. You may use wet wipes instead of rags and buckets. 2. Put on gloves. 3. Pick up any loose paint chips and place directly into trash bag. 4. Wet the rag and wash surfaces well, dip second rag in rinse water and wipe down washed surfaces. Empty water into toilet and refill buckets after each room. Repeat. If using wet wipes, dispose of them safely.	1. If your HEPA vacuum has a hose, begin by cleaning around trim or other hard-to-reach areas. 2. Vacuum the carpeting very slowly to allow dust to be pulled up. After you vacuum floor in one direction, repeat vacuuming slowly across first direction. 3. Vacuum all the surfaces on upholstered furniture by at least using the hose and attachments. 4. Use slipcovers, if possible, so they can be removed and laundered.	1. Fill 1 bucket with soapy water and fill other bucket with clean rinse water OR if using Swiffer-type mop, apply new pad. 2. Dip mop into soapy water and mop a small section. Wring and rinse mop into empty bucket and continue until floor is finished. If using Swiffer, replace pads a few times per room. 3. Empty buckets into toilet and refill after each room. Repeat as needed.

If you have questions that are not answered here, please visit https://www.epa.gov/mo/missouri-cleanups or https://www.epa.gov/lead for further guidance. If you cannot find answers to your questions online, please call our PEHSU hotline at (913) 588-6638 or toll free at (800) 421-9916, or email us at mapehsu@cmh.edu.

This material was supported by the American Academy of Pediatrics (AAP) and funded (in part) by the cooperative agreement award number 1NU61TS000296-01-00 from the Agency for Toxic Substances and Disease Registry (ATSDR).

Acknowledgement: The U.S. Environmental Protection Agency (EPA) supports the PEHSU by providing partial funding to ATSDR under Inter-Agency Agreement number DW-75-95877701. Neither EPA nor ATSDR endorse the purchase of any commercial products or services mentioned in PEHSU publications.

BEST CHILDREN'S HOSPITALS U.S.News RANKED IN 10 SPECIALTIES 2020-21

Children's Mercy

childrensmercy.org

(Out of print – Utilized by our former RN Kara White who trained me. Passed away 2023.)

Products 4: Vitamin Angels Grant/Prental Vitamins

PRODUCT 4 - VITAMIN ANGELS - PLAN AND APPLY FOR A GRANT

"Set your organization up for success in the grant application process by taking the time to prepare. First, review our eligibility criteria. Next, determine the need in the communities you serve and coordinate with your government or local health center to avoid duplication. Then, it's time to submit a grant application." (Vitamin Angels, 2026) https://vitaminangels.org/program-partners/grant-application/ For international applications. For local USA https://vitaminangels.org/program-partners/us/#application

Prenatal Multivitamin Supplement Facts

vitamin angels

VITAMIN FORMULATION

The prenatal multivitamins provided by Vitamin Angels use the United Nations International Multiple Micronutrient Antenatal Preparation (UNIMMAP) formula, which meets FDA regulations and recommended dietary allowances (RDAs) during pregnancy, **including the Centers for Disease Control and Prevention's recommended daily intake for low-risk pregnancies of 400 mcg folic acid**. The UNIMMAP Prenatal Multivitamins contain 15 essential vitamins and minerals that are needed to meet the increased nutritional requirements during pregnancy.

SUPPLEMENT FACTS

The supplement facts for the UNIMMAP Prenatal Multivitamins are listed here. For additional information about the supplement facts, visit our Prenatal Multivitamin/MMS webpage.

Supplement Facts

Serving Size: 1 Capsule
Servings Per Container: 180

Amount Per Serving		%DV*
Vitamin A (as retinyl palmitate)	800 mcg RAE (2,667 IU)	62%
Vitamin C (as ascorbic acid)	70 mg	58%
Vitamin D3 (as cholecalciferol)	5 mcg (200 IU)	33%
Vitamin E (as natural d-alpha tocopheryl succinate)	10 mg	53%
Vitamin B1 (as thiamine hydrochloride)	1.4 mg	100%
Vitamin B2 (as riboflavin)	1.4 mg	88%
Niacin (as niacinamide)	18 mg	100%
Vitamin B6 (as pyridoxine hydrochloride)	1.9 mg	95%
Folate (400 mcg Folic Acid)	667 mcg DFE	111%
Vitamin B12 (as cyanocobalamin)	2.6 mcg	93%
Iron (as iron sulfate)	30 mg	111%
Iodine (as potassium iodide)	150 mcg	52%
Zinc (as zinc oxide)	15 mg	115%
Selenium (as sodium selenite)	65 mcg	93%
Copper (as copper citrate)	2 mg	154%

Percent Daily Value (%DV) for Pregnant Women, based on a 2,000 calorie diet.

Other Ingredients: Gelatin Capsule, Silicon Dioxide, Vegetable Magnesium Stearate, and Proprietary Protective B12 Matrix.

DIETARY RESTRICTIONS

The prenatal multivitamins distributed by Vitamin Angels in the United States are manufactured specifically for this program by ProCaps Laboratories or by Contract Pharmacal Corporation. The vitamins manufactured by both companies are **Halal certified**. The ProCaps product uses **bovine gelatin capsules** (derived from cows), while the Contract Pharmacal Corporation product is offered as a tablet and does not contain gelatin. Both prenatal multivitamin products are **gluten-free**.

For additional questions, email
domesticprograms@vitaminangels.org

Chapter 4 - Discussion

This project provided valuable insight into childhood lead exposure within Wilson County Kansas and reinforced the importance of addressing both environmental and nutritional factors. While lead exposure has been widely studied, the Centers for Disease Control and Prevention (2024) states that no safe blood lead level has been identified in children and that exposure is influenced by multiple environmental and social factors. Applying a systems thinking approach in a local setting allows for a deeper understanding of how these interacting factors influence risk (Centers for Disease Control and Prevention, 2024).

One of the most important findings was the continued presence of elevated blood lead levels among children in the community. Although lead exposure is often viewed as a problem of the past due to the ban of lead-based paint in 1978 and the phase out of leaded gasoline, a portion of children in this community still showed elevated levels. Although most children screened had levels within the normal range, a portion still showed elevated levels. This confirms that lead exposure remains an active issue rather than one limited to the past. The association observed between higher blood lead levels and lower hemoglobin values further highlighted the role of nutrition, particularly iron deficiency, influencing susceptibility and outcomes This is consistent with the findings by Disalvo et al. (2025) who reported that children with higher blood lead levels were more likely to have iron deficiency and lower hemoglobin levels.

Through this experience, I gained a stronger understanding of how public health nutrition plays a critical role in environmental health issues. Prior to this project, lead exposure was often viewed primarily as an environmental problem. However, this work emphasized that nutritional

status can significantly influence how the body responds to exposure. This insight has strengthened my ability to approach public health problems more holistically.

In addition to what was learned, this project contributed to the community by identifying gaps in existing education and improving how information is delivered to families. While state level materials provide important information, they did not fully address the role of nutrition or provide practical, easy to understand guidance for families in this community. By recognizing this gap, I was able to support the development of more targeted and accessible educational materials.

My time at the Wilson County Health Department also strengthened my professional skills in communication, data interpretation, and program evaluation. Working in a rural setting highlighted the importance of adaptability and the need to tailor interventions to the specific needs and resources of the community. This experience enhanced my confidence in applying public health principles in real world settings.

There were several limitations to this project. The data analyzed was limited to a single rural county and a relatively small sample size, which may not be generalizable to larger populations. Additionally, while an association between lead levels and hemoglobin was observed, causation cannot be established. Other contributing factors may also influence these outcomes. The project was also limited by available resources and time constraints.

Despite these limitations, this project provided meaningful contributions to both my professional development and the community. It reinforced the importance of integrating

environmental health and nutrition when addressing lead exposure and demonstrated the value of systems thinking in identifying intervention points.

Future efforts should focus on expanding access to nutrition resources, increasing community awareness, and strengthening partnerships to support prevention and early intervention. Continued monitoring of lead levels and ongoing evaluation of education strategies will be important in reducing risk over time.

In conclusion, this project demonstrated that childhood lead exposure in Wilson County, Kansas is a persistent public health concern influenced by multiple interacting environmental and nutritional factors. Through analysis of local 2025 data, a subset of children was identified with elevated blood lead levels and an observed pattern between higher blood lead levels and lower hemoglobin values highlighted the role of nutrition, particularly iron deficiency, in influencing susceptibility.

The use of systems thinking tools, including a causal loop diagram (Figure 7) and a screening and follow up process flow, provided a clearer understanding of how environmental exposure, nutrition, and access to care interact. These tools also helped identify opportunities for improved intervention, including earlier identification of at-risk children and more targeted nutrition education.

In addition, this project resulted in practical improvements to community education by identifying gaps in existing materials and developing more accessible, nutrition-focused resources for families. Together, these efforts contributed to increased awareness of lead exposure risks and a more comprehensive approach to prevention.

References

Centers for Disease Control and Prevention. (2024). Childhood lead poisoning prevention. https://www.cdc.gov/lead

Disalvo, L., Varea, A., Matamoros, N., Sala, M., Fasano, M. V., & González, H. F. (2025). Blood lead levels and their association with iron deficiency and anemia in children. Biological Trace Element Research, 203(1), 69–75. https://doi.org/10.1007/s12011-024-04163-y

Flora, S. J. S., Mittal, M., & Mehta, A. (2012). Heavy metal induced oxidative stress and its possible reversal by chelation therapy. Indian Journal of Medical Research, 128(4), 501–523. https://pmc.ncbi.nlm.nih.gov/articles/PMC3827639/

Kansas Department of Health and Environment. (2023). Elevated blood lead investigation guidelines. https://www.kdhe.ks.gov/DocumentCenter/View/7220

Kansas Department of Health and Environment. (n.d.). Lead risk assessment questionnaire. Kansas Department of Health and Environment.

O'Flaherty, E. J. (2001). Physiologically based models for bone seeking elements. Toxicology, 164(1–3), 137–146. https://pubmed.ncbi.nlm.nih.gov/11684086/

United States Census Bureau. (2023). QuickFacts: Wilson County, Kansas. https://www.census.gov

Vitamin Angels. (2026). Free prenatal multivitamins for organizations in the United States. https://vitaminangels.org/program-partners/us/#application

World Health Organization. (2021). Lead poisoning and health. https://www.who.int/news-room/fact-sheets/detail/lead-poisoning-and-health

Zhai, Q., Narbad, A., & Chen, W. (2022). Dietary strategies for the treatment of cadmium and lead toxicity. Nutrients, 14(22), 4729. https://doi.org/10.3390/nu14224729

Appendix 1 - Integration of Competencies

The following section outlines the attainment of MPH Foundational Competencies and Public Health Nutrition emphasis area competencies through the completion of this Integrated Learning Experience. These competencies were demonstrated through the application of data analysis, assessment of community needs, development of targeted educational interventions, and use of system thinking tools to address childhood lead exposure in a rural setting. Each competency reflects the integration of knowledge and skills gained throughout the MPH program and their application in a real-world public health practice setting. The associated products included in Appendix 3 provide evidence of competency attainment and demonstrate the practical outcomes of this work.

The synthesis and integration of competencies were demonstrated through the application of knowledge and skills gained throughout the MPH program to address real-world public health issues. This project required the integration of epidemiology, environmental health, and public health nutrition to assess childhood lead exposure within a rural community. Data analysis, identification of environmental and nutritional risk factors, and development of targeted educational materials were combined to support both understanding and intervention. Systems thinking tools, including a causal loop diagram (Figure 7) and process flow, were used to further integrate these components and identify relationships between exposure, nutrition, and access to care. Through this process, competencies were not addressed individually but were applied collectively to develop practical, evidence-based solutions that improve public health outcomes and support community needs.

Table A.1 1Demonstration of Attainment of Competencies

Competency Area	Description of Competencies
MPH Foundational Competency #7: Assess population needs, assets, and capacities	Assessed and analyzed population-level data, including local blood lead levels and hemoglobin values, and evaluated environmental and nutritional risk factors such as older housing, anemia, and limited access to nutrient-dense foods to identify key community needs in a rural setting.
PHN Competency #2: Apply nutrition principles to public health issues	Applied and evaluated nutrition science principles by analyzing the relationship between iron deficiency, calcium intake, and lead absorption, and translated these findings into targeted prevention strategies and educational materials.
MPH Foundational Competency #22: Apply systems thinking tools to a public health issue	Applied systems thinking tools, including a causal loop diagram and process flow, to analyze interactions between environmental exposure, nutritional status, and access to care, and used these insights to inform development of targeted, community-based interventions.
MPH Foundational Competency #9: Design a population-based intervention	Designed and implemented population-based educational interventions by developing targeted materials focused on lead exposure prevention and nutrition, integrating evidence-based strategies to address identified community risk factors.
MPH Foundational Competency #18: Select	Applied and evaluated communication strategies by developing materials using plain language, visual supports, and low literacy design principles to effectively communicate

communication strategies for different audiences	complex public health information to rural and underserved populations.

Appendix 2 – Demonstration of Competency

The Integrated Learning Experience gave me the opportunity to apply what I've learned throughout the MPH program in a real-world public health setting. Through my Applied Practice Experience at the Wilson County Health Department, I addressed childhood lead exposure by integrating MPH Foundational Competency #7 (assessing population needs), MPH Foundational Competency #22 (systems thinking), and PHN Competency #2 (application of nutrition principles).

I used population assessment to analyze local blood lead level data and identify key community risk factors, including older housing and anemia. At the same time, I applied nutrition principles to better understand how iron deficiency and calcium intake influence lead absorption. These competencies were not used separately but were integrated using a systems thinking approach to connect environmental exposure, nutritional status, and access to care.

In addition to completing the written report, I presented this work through my oral presentation and major defense, which allowed me to clearly communicate findings and recommendations. I also developed practical tools, including a causal loop diagram (Figure 7) and a lead screening process flow, to demonstrate the application of systems thinking to a complex public health issue.

The following table outlines how these competencies were addressed and demonstrated throughout the experience.

Table A.2 Integration and Synthesis of Competency - Foundational and Nutrition

Specific Products	Competency
Educational materials (lead prevention and nutrition handouts)	1. MPH Foundational Competency #7: Assess population needs, assets, and capacities. Analyzed local blood lead level data and synthesized community risk factors, including older housing and anemia, to develop materials tailored to the needs of the population served.
Educational materials (lead prevention and nutrition handouts)	2. MPH Foundational Competency #9: Design a population-based intervention. Designed and implemented targeted educational materials as a population-based intervention to reduce lead exposure and improve nutritional status using evidence-based strategies.
Educational materials (lead prevention and nutrition handouts)	3. MPH Foundational Competency #18: Select communication strategies for different audiences. Applied and evaluated communication strategies through the use of plain language, visual support, and low literacy design to effectively reach rural and underserved populations.
Systems thinking tools (causal loop diagram and process flow diagram)	4. MPH Foundational Competency #22: Apply systems thinking tools to a public health issue. Analyzed and modeled relationships between environmental exposure, nutritional status, and access to care using system

	thinking tools to identify key interactions and intervention points.
Educational materials (nutrition-focused lead prevention)	5. PHN Competency #2: Apply nutrition principles to public health issues. Integrated and applied nutrition science principles by incorporating guidance on iron and calcium intake to reduce lead absorption and improve health outcomes.