

Promoting Pediatric Lead Screening

A brief review of lead and child health and an update on guidelines

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DEPARTMENT OF ENVIRONMENTAL & OCCUPATIONAL HEALTH SCIENCES
UNIVERSITY of WASHINGTON · SCHOOL OF PUBLIC HEALTH

Northwest PEHSU Pediatric Environmental Health Specialty Units

Lead & Kids: What isn't new

The developing brain is sensitive to lead exposure.

There are disparities in exposure and screening.

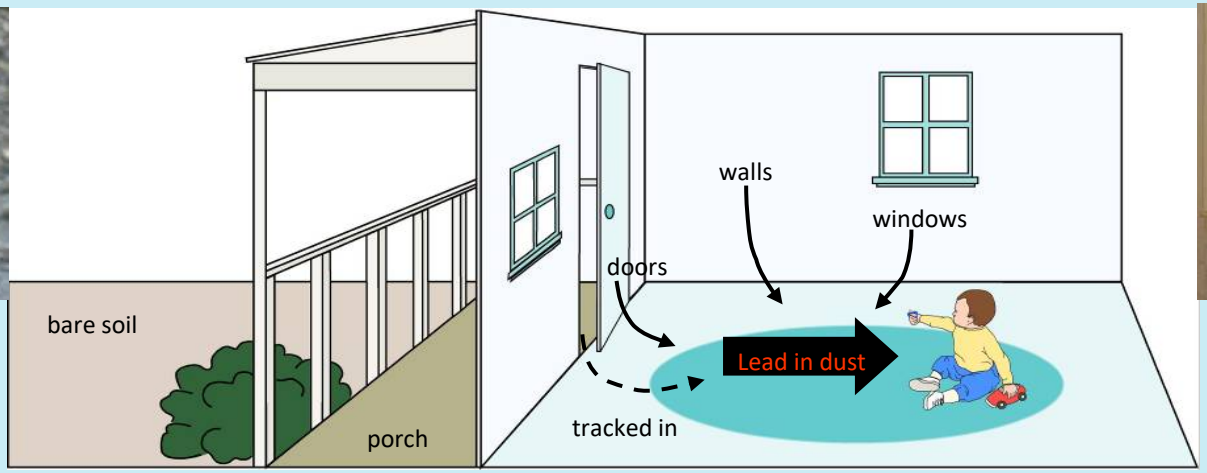
Paint remains significant source of exposure in childhood in WA and across the U.S.

Federal law mandates all children be screened for lead with a blood test

Screening rates in WA State (Medicaid and not) are low -- we do not have adequate population based prevalence data

Health care providers play an important role in primary and secondary prevention of lead exposure in children

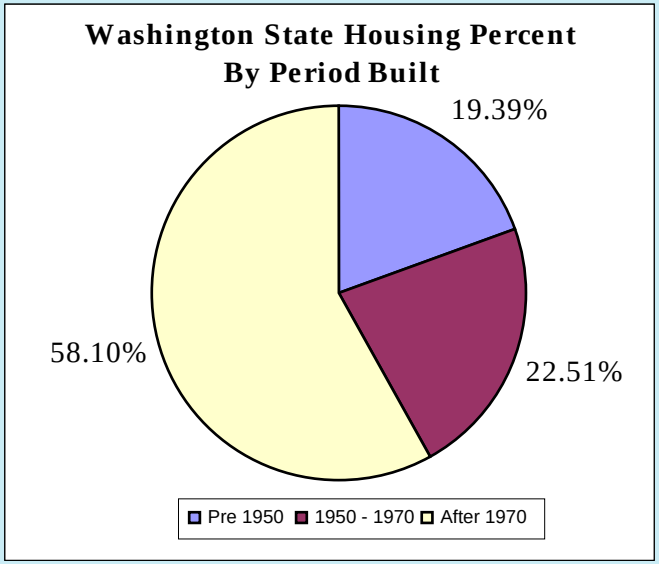
Lead Sources - House Paint



Pre-1978 homes with deteriorated leaded paint
Remodeling, repair may mobilize lead

Lead dust levels have been directly correlated with children's blood lead level (BLL)

Soil, particularly in perimeter of house



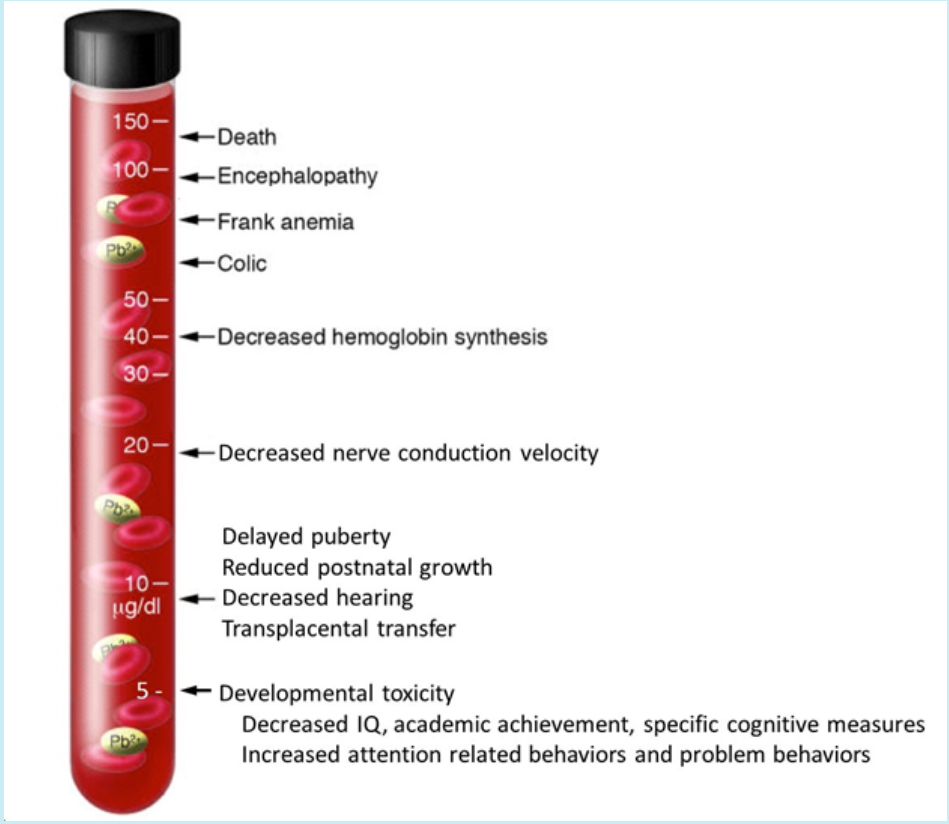
Key Pediatric Health Concerns

Signs & Symptoms
constipation, abdominal pain, fatigue, anemia, coma, fatal lead encephalopathy

Acute and high dose exposure = rare (but happens)

Chronic and low dose exposure = not rare

Most lead toxicity in U.S. children is "subclinical" – identified with blood test demonstrating elevated exposure



WHO. Childhood Lead Poisoning. 2010.

Evidence Review of Low Level Effects
Sufficient Evidence

Neurological Effects

Attention related problems
Anti social behavior
Criminal Behavior

Decreased cognitive ability
Decreased academic achievement

Decreased Hearing

Other Effects

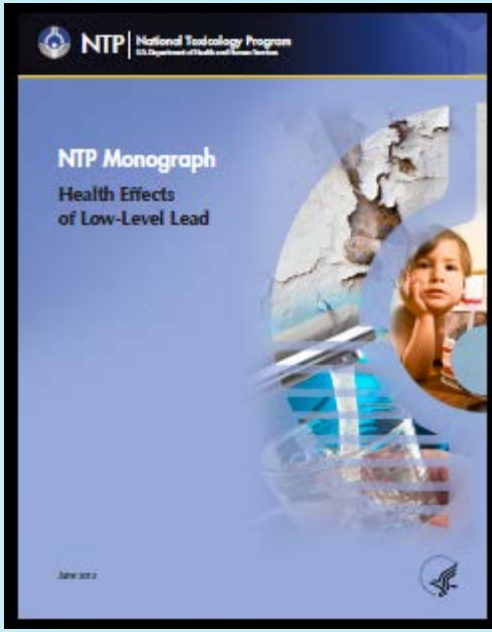
Decreased postnatal growth

Delayed puberty

Reproductive Effects

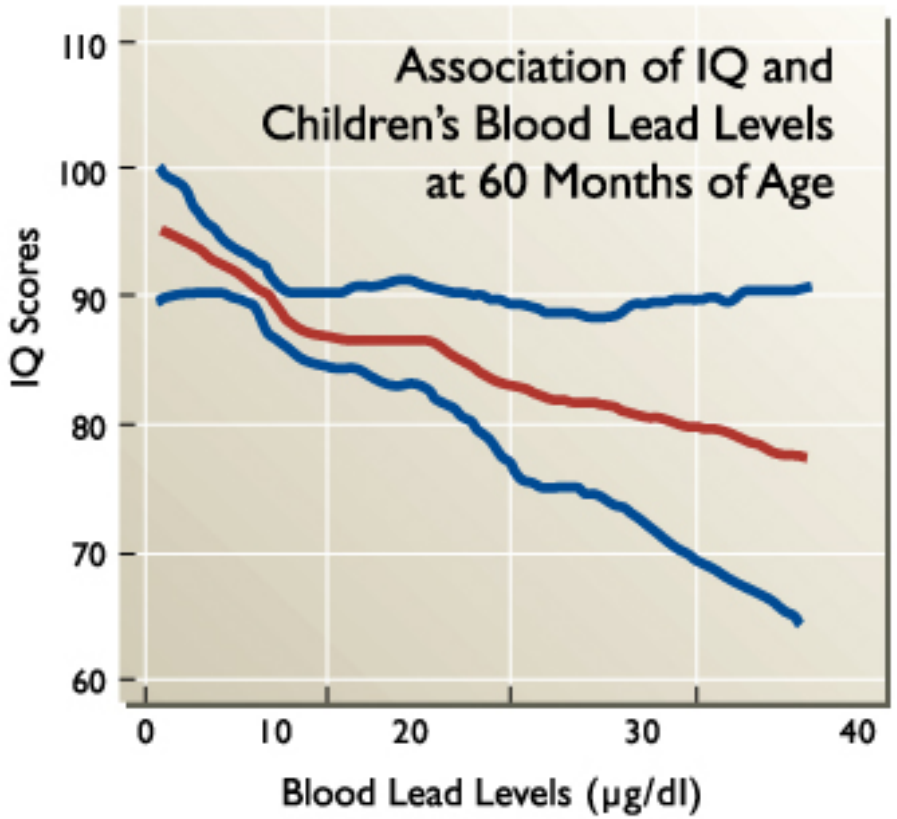
Reduced fetal growth

Adverse changes in sperm parameters and increased time to pregnancy



National Toxicology Program 2012

No Threshold = No Safe Level



Canfield 2003

ADHD Risk

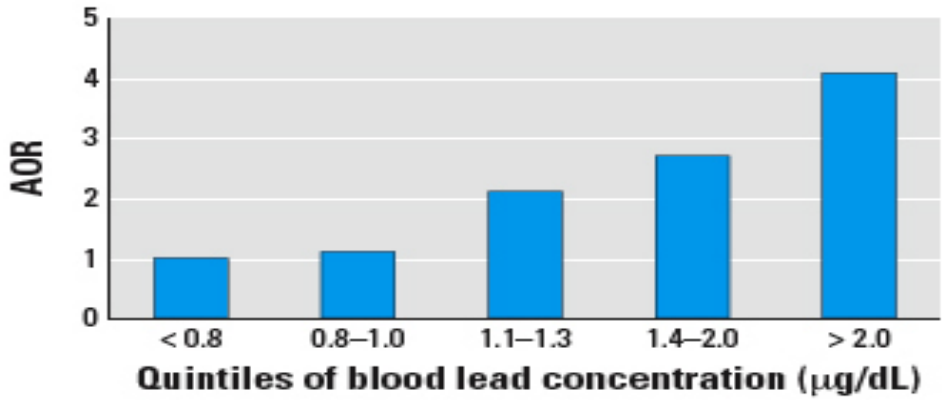


Figure 1. AOR for ADHD among U.S. children, NHANES 1999–2002, by blood lead concentration (µg/dL). The model was adjusted for child's age, sex, race/ethnicity, preschool attendance, serum ferritin, prenatal ETS exposure, smoker in the household, and insurance status.
p-value for trend = 0.012.

Braun 2006

Expected vs. Reported Lead Cases- State by State[1]

The majority of states successfully identify *fewer than half* their children with EBLLs

WA identified the fewest

(CDC data 2016

6% of children screened) [2]

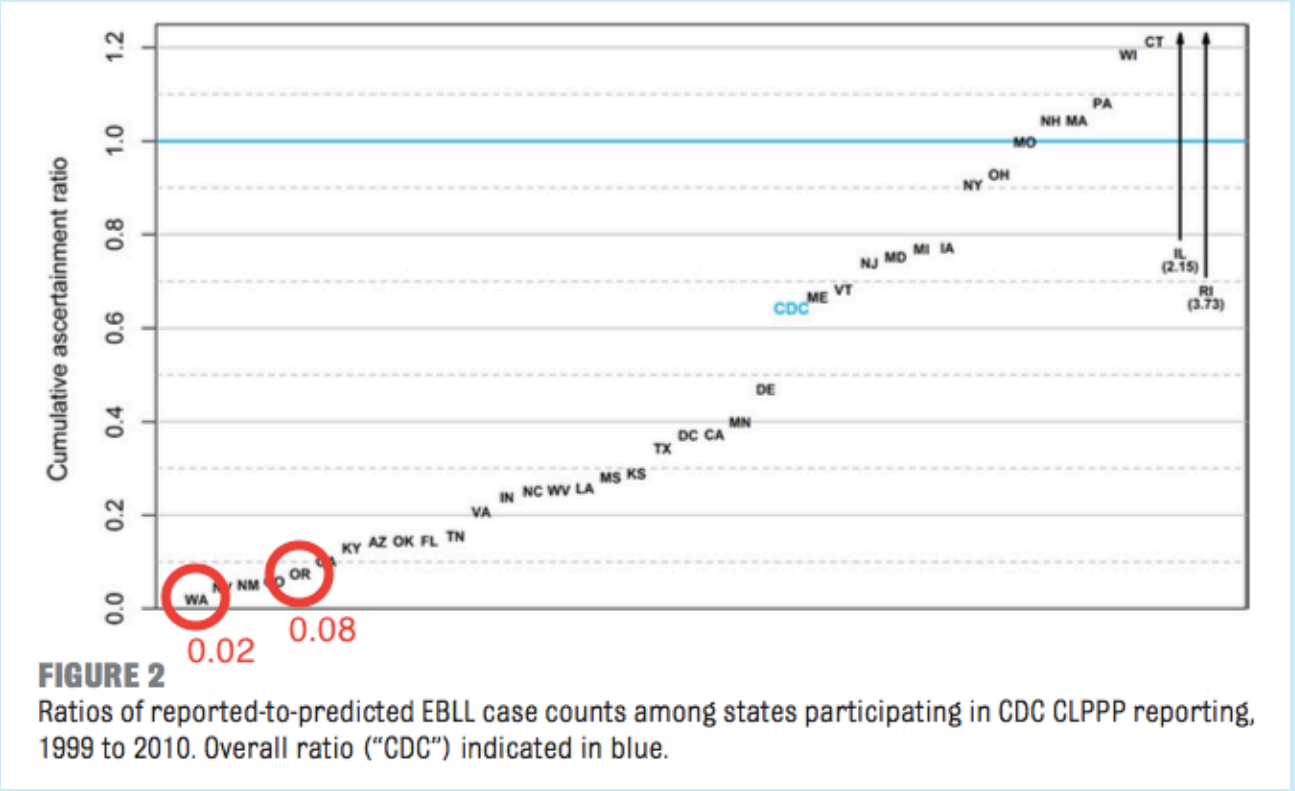


FIGURE 2
Ratios of reported-to-predicted EBLL case counts among states participating in CDC CLPPP reporting, 1999 to 2010. Overall ratio ("CDC") indicated in blue.

1. Roberts EM et al. *Pediatrics.* 2017;139(5):e20164266
2. https://www.cdc.gov/nceh/lead/data/CBLS-National-Table-508.pdf

Federal Rules

Federal law mandates lead testing test for all children covered by Medicaid at 12 and 24 months.

HEDIS Measure for Lead Screening in Children:

Number of children 2 years of age who had one or more blood tests for lead poisoning by their second birthday.

Lead & Kids: What's New (kind of)

New Public Health Action Level aka "reference level" 5 mcg/dL (2012)

CDC guidance for lead testing of newly arriving immigrants (2013)

Flint! – sources of concern beyond lead paint (2015)

WA State Screening Guidelines (2016)
Screening identifies asymptomatic kids with exposures of concern and provides opportunity for intervention to reduce exposure as soon as possible

www.doh.wa.gov/Portals/1/Documents/Pubs/334-383.pdf

WA Guidelines – Risk Based Blood Lead Testing

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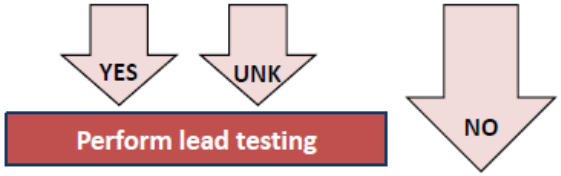
An algorithm for blood level testing of children at age 12 and 24 months

Does the child have any of the following risk factors:

- Lives in or regularly visits any house built before 1950.*
- Lives in or regularly visits any house built before 1978 that has recent or ongoing renovations or remodeling.
- From a low income family (defined as incomes <130% of the poverty level.)**
- Known to have a sibling or frequent playmate with elevated blood lead level.
- Is a recent immigrant, refugee, foreign adoptee, or child in foster care.
- Has a parent or principal caregiver who works professionally or recreationally with lead. (See sidebar for examples.)
- Uses traditional, folk, or ethnic remedies or cosmetics (such as Greta, Azarcon, Ghasard, Ba-baw-san, Sindoor or Kohl.)

* Screening may not be indicated if the home has previously undergone lead abatement or tested negative for lead after remodeling.

** Federal law mandates testing for all children covered by Medicaid.



Healthcare providers should consider testing additional children per clinical judgment, such as:

- Child whose parents have concern or request testing (including older children that have risk of exposure.)
- Child living within a kilometer of an airport or lead emitting industry or on former orchard land.
- Child with pica behavior.
- Child with neurodevelopmental disabilities or conditions such as autism, ADHD, and learning delays.

LEAD RISK EXPOSURE EXAMPLES:

Occupations and Hobbies:

- *Remodeling and demolition*
- *Painting*
- *Work or visit gun range*
- *Mining, smelting, battery recycling*
- *Making lead fishing weights or ammunition*
- *Stained glass*
- *Soldering and welding*

Consumer Products:

- *Pottery or porcelain with lead glaze*
- *Informally imported foods, candies and spices*
- *Antique furniture and inexpensive jewelry*

www.doh.wa.gov/Portals/1/Documents/Pubs/334-394.pdf

WA Lead Reporting

Laboratories are required to report any BLL >= 5 within two business days and all other BLLs measured must be reported within one month.

If a clinic does point of care testing for blood lead, those results must be reported (clinic is the lab).

WA DOH reviews the results, and will convey EBLLs to local health departments. Local health departments are offering/developing a suite of services depending on the resources available, including home visit and case managers.

Blood Lead Level Range	Recommended Public Health Response
5.0 – 7.5 µg/dL	Contact provider. A letter (see Appendix E) and educational brochures are sent to the family.
7.5 – 10.0 µg/dL	Contact provider. The family is contacted by phone, interviewed to identify sources of the lead exposure (see Appendix F) and educated to minimize exposure to lead and its health impacts. An action plan letter and educational brochures are sent to the family and health care provider.
Above 10.0 µg/dL	Contact provider. Depending on local health resources, the family may be contacted to schedule an in-home investigation. During the investigation analytical sampling with X-ray fluorescence (XRF) is used to identify the source of the lead exposure. The investigator works with the family to develop an action plan to eliminate the exposure. Interpreters may be provided if needed.

For more info, see WA DoH
"A Targeted Approach to Blood Lead Screening in WA State" www.doh.wa.gov/Portals/1/Documents/Pubs/334-383.pdf

CDC 2013 Screening for Lead during the Domestic Medical Examination for Newly Arrived Refugees

- Check BLL of all refugee children **6 months–16 years of age** upon their arrival in the United States (generally within 90 days, preferably within 30 days of arrival).
- Within 3–6 months post-resettlement, a follow-up blood lead test should be conducted on all refugee children aged **6 months–6 years of age**, regardless of the initial screening BLL result.
- Within 90 days of their arrival in the United States, children aged **6 months–6 years of age** should also undergo nutritional assessment and testing for hemoglobin or hematocrit level with one or more of the following: mean corpuscular volume (MCV) with the red cell distribution width (RDW), ferritin, transferrin saturation, or reticulocyte hemoglobin content. A routine complete blood count with differential is recommended for all refugees following their arrival in the United States, and these red cell parameters are included in this testing.
- Provide daily pediatric multivitamins with iron to all refugee children aged **6 months–6 years of age**.

www.cdc.gov/immigrantrefugeehealth/pdf/lead-guidelines.pdf

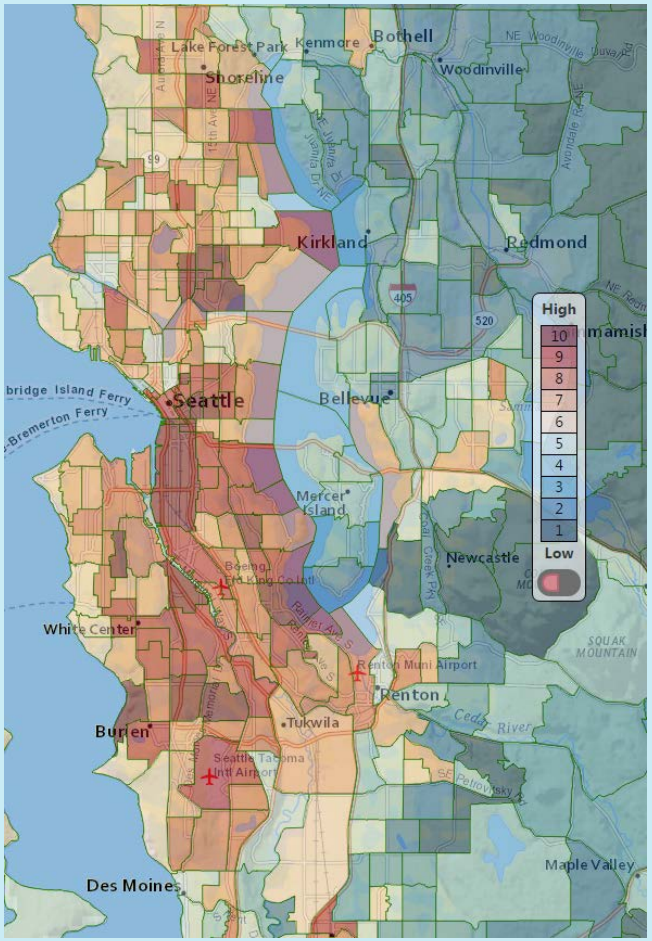
Another tool for identifying risk
WA DOH Lead Risk Index Map

Derived from data on poverty and housing age

Available at:
https://fortress.wa.gov/doh/wtn/WTNIBL

Input patient address or a zipcode….

Available for all of WA State



Lead Sources – beyond paint

- Pottery - imported, old, handmade or poorly glazed); leaded crystal, pewter and brass dishware
- Imported spices, candy (Mexico)
- Home remedies and cosmetics (immigrants/refugees)
- Workplace & hobbies (welding, smelting, auto/boat repair, ceramics, stained glass, bullets, fishing weights, furniture refinishing, home remodeling, painting, target shooting/firing ranges, wild game ingestion)
- Leaded gasoline & exhaust (historically; also some aviation gas still leaded)
- Adopted from, lived in, or traveled to another country
- Drinking water (water pipes & solder & fixtures)
- Furniture, toys, jewelry (antique & modern)
- If <9-12months- prenatal transmission or breastmilk

Recommendations on Medical Management of Childhood Lead Exposure and Poisoning

PEHSU Pediatric Environmental Health Specialty Units

No level of lead in the blood is safe. In 2012, the CDC established a new "reference value" for blood lead levels (5 mcg/dL), thereby lowering the level at which evaluation and intervention are recommended (CDC).

Lead level	Recommendation
< 5 mcg/dL	1. Review lab results with family. For reference, the geometric mean blood lead level for children 1-5 years old is less than 2 mcg/dL . 2. Repeat the blood lead level in 6-12 months if the child is at high risk or risk changes during the timeframe. Ensure levels are done at 1 and 2 years of age. 3. For children screened at age < 12 months, consider retesting in 3-6 months as lead exposure may increase as mobility increases. 4. Perform routine health maintenance including assessment of nutrition, physical and mental development, as well as iron deficiency risk factors. 5. Provide anticipatory guidance on common sources of environmental lead exposure: paint in homes built prior to 1978, soil near roadways or other sources of lead, take-home exposures related to adult occupations, imported spices, cosmetics, folk remedies, and cookware.
5-14 mcg/dL	1. Perform steps as described above for levels < 5 mcg/dL. 2. Re-test venous blood lead level within 1-3 months to ensure the lead level is not rising. If it is stable or decreasing, retest the blood lead level in 3 months. Refer patient to local health authorities if such resources are available. Most states require elevated blood lead levels be reported to the state health department. Contact the CDC at 800-CDC-INFO (800-232-4636) or the National Lead Information Center at 800-424-LEAD (5323) for resources regarding lead poisoning prevention and local childhood lead poisoning prevention programs. 3. Take a careful environmental history to identify potential sources of exposures (see #5 above) and provide preliminary advice about reducing/eliminating exposures. Take care to consider other children who may be exposed. 4. Provide nutritional counseling related to calcium and iron. In addition, recommend having a fruit at every meal as iron absorption quadruples when taken with Vitamin C-containing foods. Encourage the consumption of iron-enriched foods (e.g., cereals, meats). Some children may be eligible for Special Supplemental Nutrition Program for Women, Infants and Child (WIC) or other nutritional counseling. 5. Ensure iron sufficiency with adequate laboratory testing (CBC, Ferritin, CRP) and treatment per AAP guidelines. Consider starting a multivitamin with iron. 6. Perform structured developmental screening evaluations at child health maintenance visits, as lead's effect on development may manifest over years.
15-44 mcg/dL	1. Perform steps as described above for levels 5-14 mcg/dL. 2. Confirm the blood lead level with repeat venous sample within 1 to 4 weeks. 3. Additional, specific evaluation of the child, such as abdominal x-ray should be considered based on the environmental investigation and history (e.g., pica for paint chips, mouthing behaviors). Gut decontamination may be considered if leaded foreign bodies are visualized on x-ray. Any treatment for blood lead levels in this range should be done in consultation with an expert. Contact local PEHSU or PCC for guidance; see resources on back for contact information.
>44 mcg/dL	1. Follow guidance for BLL 15-44 mcg/dL as listed above. 2. Confirm the blood lead level with repeat venous lead level within 48 hours. 3. Consider hospitalization and/or chelation therapy (managed with the assistance of an experienced provider). Safety of the home with respect to lead hazards, isolation of the lead source, family social situation, and chronicity of the exposure are factors that may influence management. Contact your regional PEHSU or PCC for assistance; see resources on back for contact information.

deohs.washington.edu/pehsu/

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Medical Management

Environmental history

Identify and remove source(s)
(clinician-health dept. collaboration)

Monitor repeat BLLs

Nutritional status/counselling
- Calcium/Iron
- Vitamin C

At higher levels, maybe doing more labs and/or imaging.

Anemia screening

ZPP, ab x-ray

Neurodevelopmental screening and consider enrichment

Consult specialist for > 20 mcg/dL

(pehsu.net)

Lead Anticipatory Guidance for families with young children – **paint hazards messages**

- Keep your child away from peeling paint and home repairs that disturb lead paint.
- Report peeling paint to your landlord. If your landlord does not make repairs, contact your local tenant rights organization
- Frequently wash hands, toys, pacifiers, bottles and other items your child places in his or her mouth.
- Clean floors, windowsills, and dusty places often with wet mops and wet cloths.
- Use safe methods when doing home repair that disturbs paint. For information on lead safe methods see EPA's lead webpage at www.epa.gov/lead

Lead Anticipatory Guidance for families with young children – **beyond paint**

- Avoid using health remedies (such as azarcon, greta, paylooah) and eye cosmetics (such as kohl, kajal, surma) from other countries. Some of these products have been found to contain high levels of lead.
- Use caution when using candles, spices, snack foods, and children's toys and jewelry made in other countries. These may contain lead.
- Keep your child away from work clothes and tools of household members who do construction work or other work or hobbies that may expose them to lead
- Wash work clothes separately from other laundry. Remove work clothes and shoes before entering your home.

Factsheets on Traditional Sources

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Traditional Sources of Lead Exposures in Immigrant Populations

for clinicians

No level of lead in the blood is safe. At low levels, lead exposure may lead to neurodevelopmental problems and at high levels, lead poisoning may be fatal. Immigrant and refugee children are at especially high-risk for lead exposure due to their frequency of living in old housing stock and some traditional practices. This document provides a visual guide for clinicians to use to identify traditional sources of lead exposure in various immigrant populations.

Please note that not *all* listed spices, candy, and plant-based substances will always contain lead; keep them in mind as potential exposure sources given elevated blood lead levels. Furthermore, since new sources of lead are identified over time, this list is not comprehensive.

Common Potential Exposures for all Populations

- Glazed pottery– even if it says lead free.
- Some imported Cosmetics.
- Metal Jewelry.
- Some imported spices and candies.
- Old painted wooden and metal toys.
- Living in old homes with paint chips or lead pipes.
- Contaminated Soil.

For more information on the medical management of lead poisoning, go to: www.deohs.washington.edu/pehsu/factsheets

For additional questions or guidance, contact the NW PEHSU at 1-800-KID-CHEM or pehsu@uw.edu, or visit our website http://www.deohs.Washington.edu/pehsu

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Traditional Potential Sources of Lead Exposure in South Asian Immigrant Populations**

Substance	Use
Bali goli/ bali gali, bala gali, ghasard. *Red or brown powder or black, flat bean.*	Treats upset stomachs.
Deshi Dewa, Koo Sar*. *Plant based pills.*	Addresses fertility issues, menstrual cramps.
Gugglu, Guggulu*. *Herbal supplement from Indian bdellium tree (myrrh). Typically orange, yellow, or brown powder.*	Maintains joint and heart health.
Jambrulin*. *Ayurvedic herbal medicine.*	Controls diabetes and sugar.
Kandu. *Red, lead containing powder.*	Treats stomach aches.
Kohl (Surma, Sacott), Alkohl. *Black powder made from lead or antimony sulfide.*	Treats skin infections, used as an astringent for eye injuries, and as a cosmetic.
Kustha, kushta*. *Root.*	Treats heart, liver, and brain diseases, and stomach aches.
Sundari Kalp, Sundri Kalp*. *Herbal supplement containing Ashok Bark, Nagarmotha, sonth, Dhataki, Bala, Dalchini and Kamal Phool .*	Treats menopause symptoms and addresses nutritional and stomach disorders.

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**Since new sources are recognized over time, this list is not comprehensive

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Guidance on reducing lead in drinking water

- **If you live in older housing** (pre mid-1940s) run tap >2 minutes after water has sat in the pipes for > 6 hours. This will help flush out any lead that may have accumulated in your pipes.
- **If you live in newer housing** and are concerned, you can flush your pipes by running your tap until the water is noticeably cooler.
- Use only cold water for drinking, cooking, and making baby formula. Hot water may contain higher levels of lead.
- Clean the screens and aerators in faucets frequently to remove captured lead particles.
- Use only “lead free” piping and materials for plumbing when building or remodeling.
- Consider using a filter.
  Check whether it reduces lead - not all filters do. Be sure to maintain and replace a filter device in accordance with the manufacturer's instructions. Contact NSF for performance standards

Lead and Drinking water factsheet available at deohs.washington.edu/pehsu/

Promoting Healthy Neurocognitive Development

Lead exposure not “reversible”; but exposure not guarantee of damage either…

Cognitive and behavioral development is positively influenced by nurturing (parents, caregivers, teachers) and safe, stable, supportive environment…

- ✓ Good nutrition
- ✓ Educational enrichment
- ✓ Physical activity
- ✓ Limited screen time
- ✓ Safe environments
- ✓ Good sleep

Disclaimer and acknowledgements

- Funded by the Washington State Department of Health
- The findings and conclusions in this presentation have not been formally disseminated by the Agency for Toxic Substances and Disease Registry and should not be construed to represent an agency determination or policy.
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Instructions for Obtaining Continuing Education (CE)

In order to receive continuing education (CE) for Promoting Pediatric Lead Screening- **RP4059** please visit TCEO (CDC.gov/GetCE) and follow these 9 Simple Steps before 30 days post-presentation.

- Course Title: Promoting Pediatric Lead Screening
- Course code: LeadScreeningOctober4

Complete the activity

Complete the Evaluation at www.cdc.gov/GetCE

Pass the posttest at (80%) at www.cdc.gov/GetCE

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www.pehsu.net

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Managing very high BLLS (> 44 mcg/dL) Chelation Therapy

Outpatient? Not if:

Exposure not identified, likely ongoing

Symptomatic

Ingestion of lead containing object

Unlikely to be able to follow through with dosing

Oral meso-2,3-dimercaptosuccinic acid (DMSA, succimer)

- Contraindications: ongoing lead exposure, hepatic insufficiency
- Adverse effects: GI, hematologic, allergic responses
- Requires ongoing monitoring of LFTs

Consult specialist - Poison Center or PEHSU