Update on The Prevention of Childhood Lead Poisoning: Why Physicians Should Counsel on Lead and Screen for Lead Exposure

Directly Provided CME/CE Activity by L.A. Care Health Plan

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California Department of Public Health

LA Care Pre-Test

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Financial Disclosures

The following CME Planners and Faculty do not have relevant financial relationships with ineligible companies in the past 24 months.

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The following ineligible companies have relevant financial relationships with CME Presenter Jean Woo, MD, MPH, MBA, Public Health Medical Officer II, Center for Healthy Communities (CHC), California Department of Public Health (CDPH), Childhood Lead Poisoning Prevention Branch, CME Faculty.

- Abbott, Astra Zeneca, Becton Dickinson, Biomarin, Cue Biopharma, Cue Health, Dexcom, Hoth. Merck, Sorrento, Thermo Fisher, Vertex, Johnson & Johnson, Lilly, Lucira, Novartis, Sanofi, Quest, Pfizer, Moderna, Roche, Spectrum.
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Overview of CDPH Childhood Lead Poisoning Prevention Program

Vision: A healthy, lead-safe environment where all children can achieve their full potential.
Mission: To eliminate childhood lead poisoning by identifying and caring for children who are lead-burdened and preventing environmental exposures to lead.

Goal 1 **Program Support**	Goal 2 **Partnerships**	Goal 3 **Lead-Safe Environments**
Goal 4 **Data-Driven Research**	Goal 5 **Blood Lead Testing**	Goal 6 **Robust Case Management**

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Learning Objectives

- Describe the scope, risk factors, clinical effects, and management of childhood lead exposure
- Identify cultural risk factors for lead exposure and identify children in all socioeconomic groups who may be at risk for lead exposure
- Describe California's Childhood Lead Screening statutes and regulations, provider mandates, and the role of anticipatory guidance in preventing childhood lead exposure
- Outline health and environmental interventions for children with lead exposure
- Discuss services provided by the State of California and local Childhood Lead Poisoning Prevention Programs

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Learning Objectives (cont'd.)

At the completion of the activity, learners can:

- List three (3) risk factors for childhood lead exposure.
- Identify two (2) age groups for appropriate blood testing of at-risk children.
- Name two (2) blood lead screening methods accepted in California and appropriate circumstances for using each method when testing blood lead in at-risk children.
- Summarize three (3) potential effects of lead exposure in children under age 6.

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Overview: Scope of the Problem

- Lead poisoning is one of the most common and preventable environmental diseases in California children.
- No blood lead level known to be without a deleterious effect.[1,2,3]
- Prevention is the best approach, so children are not exposed.
- Screening (blood lead testing) is the approach to early diagnosis of exposure, if it has occurred.

[1] MMWR November 2007;56(RR08):1-14:16
[2] Koller et al. EHP, Jun 2004: 112:987-994
[3] Bellinger, Current Opinions in Pediatrics, 2008, 20:172-177

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California Statutes and Regulations for Providers Caring for Children 6 Months to 6 Years of Age[1]

ANTICIPATORY GUIDANCE	At each periodic assessment from 6 months to 6 years. Under California state laws and regulations, all health care providers are required to inform all parents and guardians about: • The risks and effects of childhood lead exposure. • The requirement that children enrolled in Medi-Cal receive blood lead tests. • The requirement that children not enrolled in Medi-Cal who are at high risk of lead exposure receive blood lead tests.

[1] Health and Safety Code, sections 105285-105286; California Code of Regulations, Title 17, Sections 37000 to 37100

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California Statutes and Regulations for Providers Caring for Children 6 Months to 6 Years of Age[1]

BLOOD LEAD TEST	• All children in publicly supported programs such as Medi-Cal, Women, Infants and Children (WIC), and CHDP at both 12 months and 24 months of age. • Perform a "catch up" test for children age 24 months to 6 years in a publicly supported program who were not tested at 12 and 24 months.

[1] Health and Safety Code, sections 105285-105286; California Code of Regulations, Title 17, Sections 37000 to 37100

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California Statutes and Regulations for Providers Caring for Children 6 Months to 6 Years of Age[1]

ASSESS	• If child is not in a publicly supported program: **Ask:** "Does your child live in, or spend a lot of time in, a place built before 1978 that has peeling or chipped paint or that has been recently remodeled?" **Blood lead test if the answer to the question is "yes" or "don't know."**

[1] Health and Safety Code, sections 105285-105286; California Code of Regulations, Title 17, Sections 37000 to 37100

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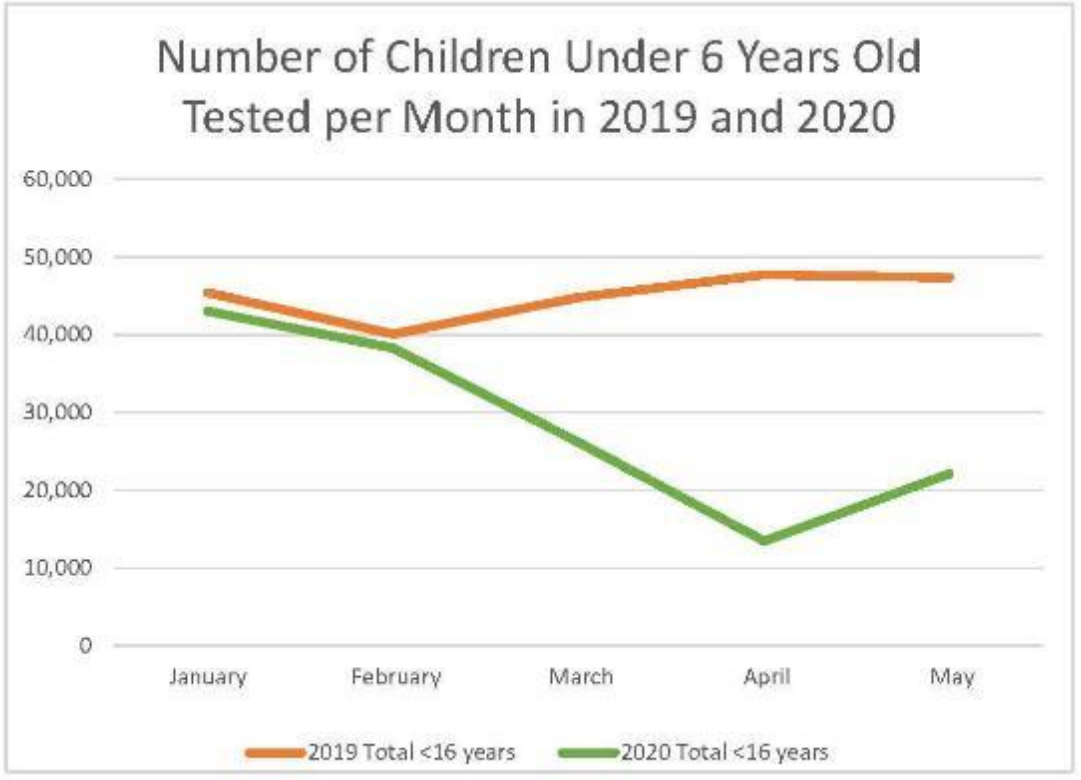
Gaps in Childhood Blood Lead Testing During COVID-19 Pandemic

- During the COVID-19 pandemic in 2020, 28% fewer California children under 6 years old were tested compared to 2019.
- Children who missed mandated blood lead testing need catch-up testing.



[1] CLPPB, California's Progress in Preventing and Managing Childhood Lead Exposure, 2022

[2] CLPPB, Strategies to Address Declining Blood Lead Screening Rates During COVID-19, 08/2020

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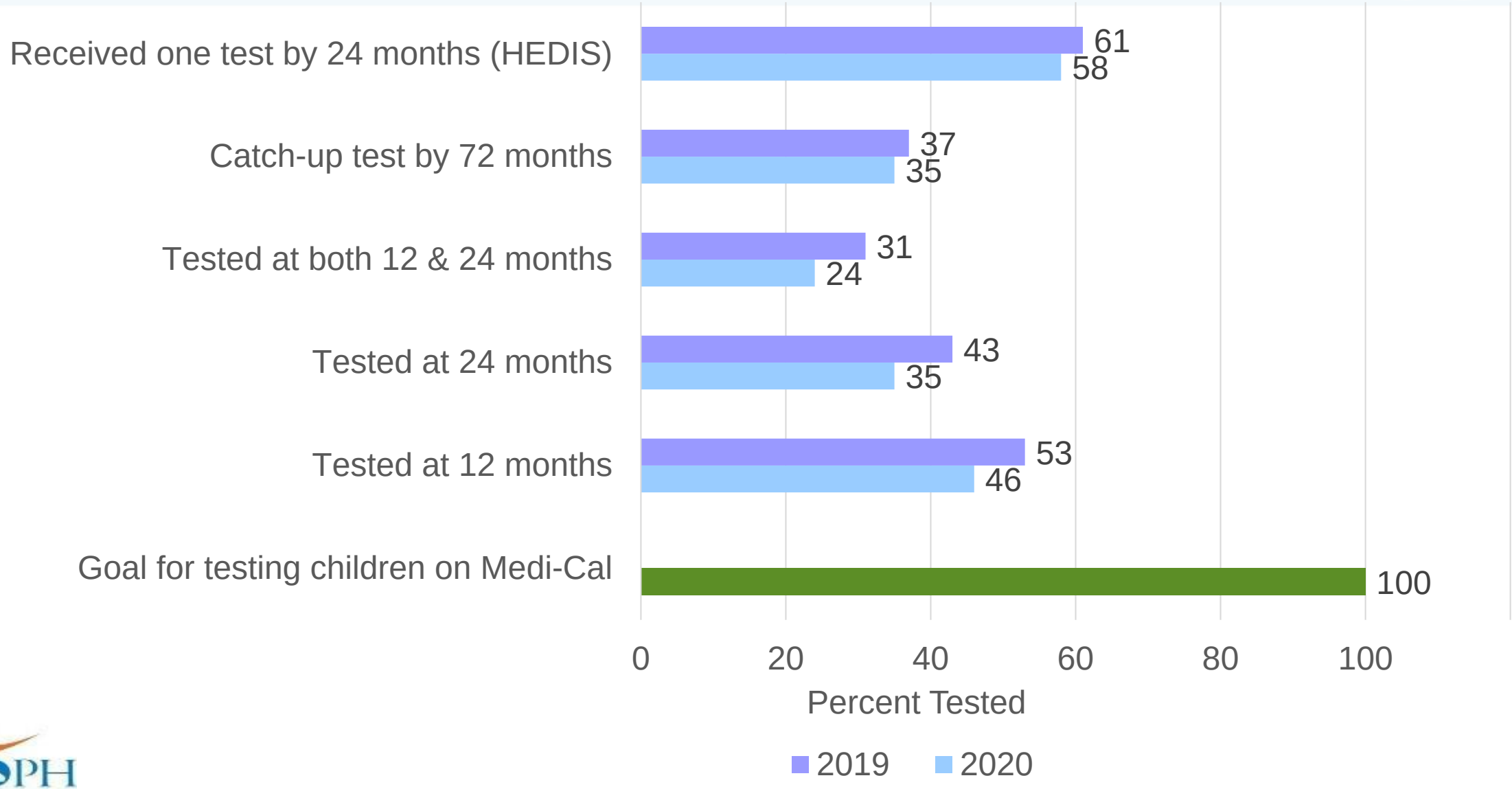
HEDIS[1] and Lead Testing Requirements

- Health Care Effectiveness Data and Information Set (HEDIS) measures
  - Standardized performance measures applied to federally funded Medi-Cal HMOs
  - 'Require at least one capillary or venous blood lead test by child's 2nd birthday"[1]
- California mandates are different from HEDIS measures: **Two** tests are required. Test at **both** 12 months and 24 months of age
  - 12 month test provides for early identification and intervention for children with lead exposure
  - 24 month test is important because blood lead levels can be high at 24 months even if not elevated at 12 months of age

[1]National Committee for Quality Assurance (NCQA). Lead Screening in Children (LSC)

Percent of Medi-Cal Children Age < 6 Years Who Received Screening Tests 2019 and 2020



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California Childhood Lead Poisoning Prevention Program 2018-2020 Statistics – Age < 6 Years[2]

	2018	2019	2020
Total Children Tested for BLL*	480,954	473,396	368,813
Total BLL ≥ 4.5 mcg/dL and < 9.5 mcg/dL[1]	5850 (1.22%)	4575 (0.97%)	3292 (0.97%)
Total BLL ≥ 9.5 mcg/dL[1]	1291 (0.27%)	1128 (0.24%)	838 (0.25%)

*BLL = Blood Lead Level

[1]BLLs are rounded to the closest whole integer (5 includes 4.5 mcg/dL,10 includes 9.5 mcg/dL, 15 includes 14.5 mcg/dL)

[2] CLPPB, Blood Lead Level (BLL) Data by Jurisdiction

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2021 Children with BLL ≥ 3.5 mcg/dL

	Total N	N ≥ 3.5 mcg/dL	Percent ≥ 3.5 mcg/dL
Age <6	370,981	6,973	1.88
Age 6-21	37,468	1,522	4.06
Total Age <21	408,449	8,495	2.08

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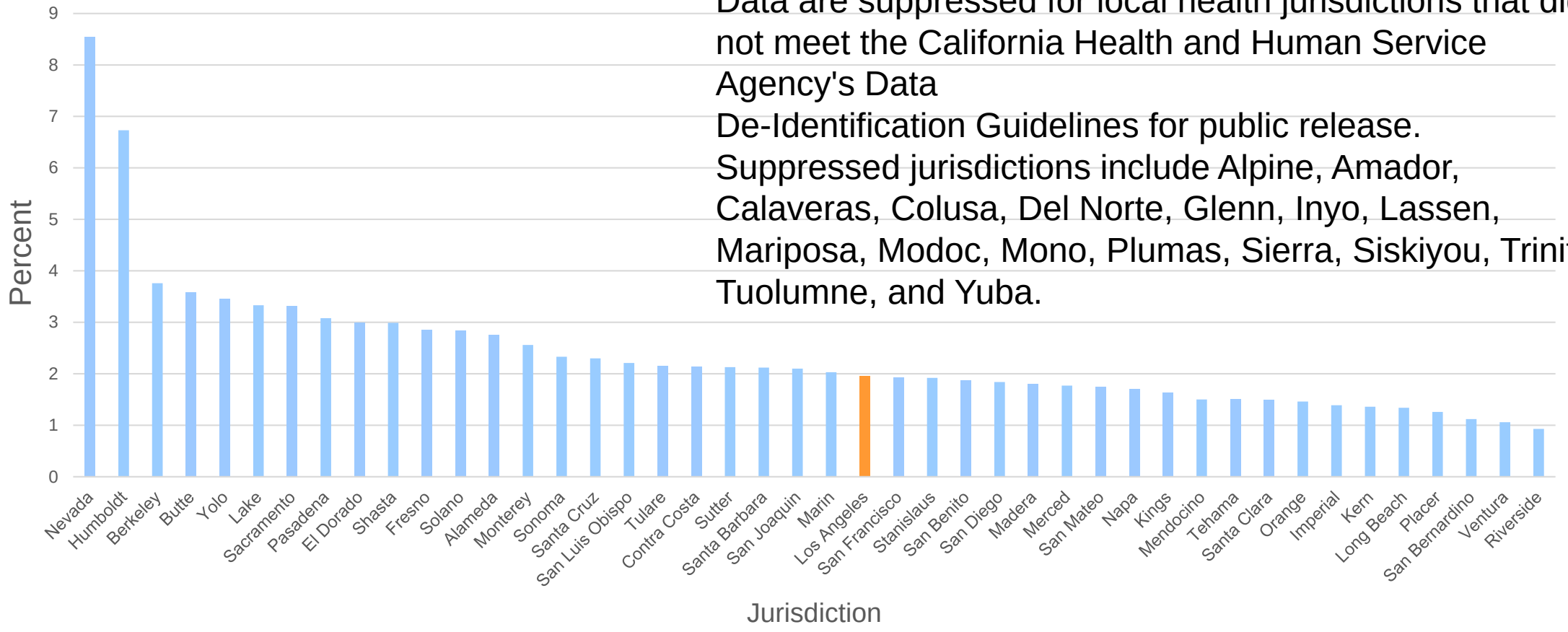
Percent of Children Age < 6 Years Screened for Lead with BLLs ≥ 3.5 mcg/dL, Selected Jurisdictions*, 2021



Data are suppressed for local health jurisdictions that did not meet the California Health and Human Service Agency's Data De-Identification Guidelines for public release. Suppressed jurisdictions include Alpine, Amador, Calaveras, Colusa, Del Norte, Glenn, Inyo, Lassen, Mariposa, Modoc, Mono, Plumas, Sierra, Siskiyou, Trinity, Tuolumne, and Yuba.

* Graph does not include suppressed jurisdictions

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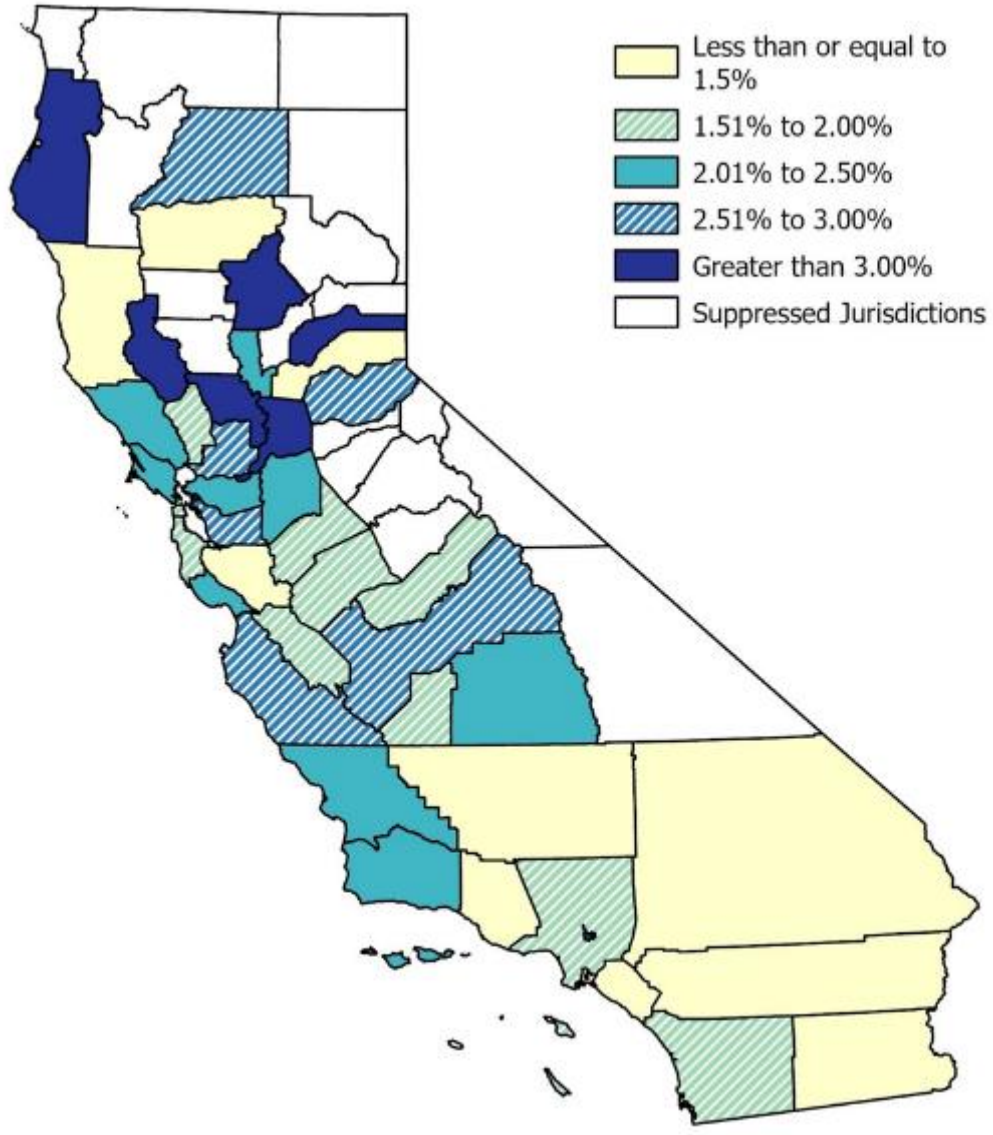
Percent of Children Age < 6 Years Screened (Tested) for Lead with a BLLs ≥ 3.5 mcg/dL by Jurisdiction, 2021



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Percent of Medi-Cal Recipients BLL Tested in 2019[1] and 2020[2] by Race/Ethnicity

Race / Ethnicity	Tested at 12 Months		Tested at 24 months	
	2019	2020	2019	2020
American Indian or Alaska Native	40	39	33	27
Asian	60	53	46	36
Black/African-American	35	30	29	22
Hispanic/Latino	59	51	49	39
Native Hawaiian or Other Pacific Islander	43	29	28	26
White/Caucasian	44	40	34	28
Other	50	44	40	33
Unknown/Missing	48	41	38	29
Statewide Aggregate	**53**	**46**	**43**	**35**

References Slide 227

Percent of Medi-Cal Recipients BLL Tested in 2019[1] and 2020[2] by Race/Ethnicity

Race / Ethnicity	Both Tests by 24 months		HEDIS - One Test by 24 months		Catch-up by 6 years	
	2019	2020	2019	2020	2019	2020
American Indian or Alaska Native	21	16	52	47	31	31
Asian	35	26	68	65	45	41
Black/African-American	15	11	45	41	35	35
Hispanic/Latino	36	29	67	64	42	41
Native Hawaiian or Other Pacific Islander	16	16	52	46	29	31
White/Caucasian	21	18	49	48	25	24
Other	27	22	57	56	38	35
Unknown/Missing	25	19	55	52	32	27
Statewide Aggregate	**31**	**24**	**61**	**58**	**37**	**35**

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Lead Exposure is Measured By Blood Lead Levels

- Since 2003, all blood lead levels are reported to the State of California
- The blood lead level is a biomarker that reflects both short and long-term exposure
  - Current exogenous sources
  - Slow release associated with bone remodeling
    - Accelerated during periods of rapid growth, post fractures, prolonged bedrest or immobilization
    - May be higher during pregnancy and breastfeeding

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Blood Lead Reference Value[1,2]

- The CDC “Level of Concern” decreased from 60 mcg/dL in 1960 to 10 mcg/dL in 1991
- In 2021, the CDC announced a change in its blood lead reference value (BLRV) from ≥ 5 mcg/dL[1] to ≥ 3.5 mcg/dL[2].
- The BLRV is a population-based measurement which indicates that 2.5% of U.S. children aged 1–5 years have BLLs ≥ 3.5mcg/dL.
- It is not a health-based standard or a toxicity threshold.

[1] CDC Response to Advisory Committee on Childhood Lead Poisoning Prevention Recommendations in “Low Level Lead Exposure Harms Children: A Renewed Call of Primary Prevention”

[2] CDC, Update of Blood Lead Reference Value – United States, 2021, MMWR / October 29, 2021 / Vol. 70 / No. 43

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CDC Recommended Actions[1]

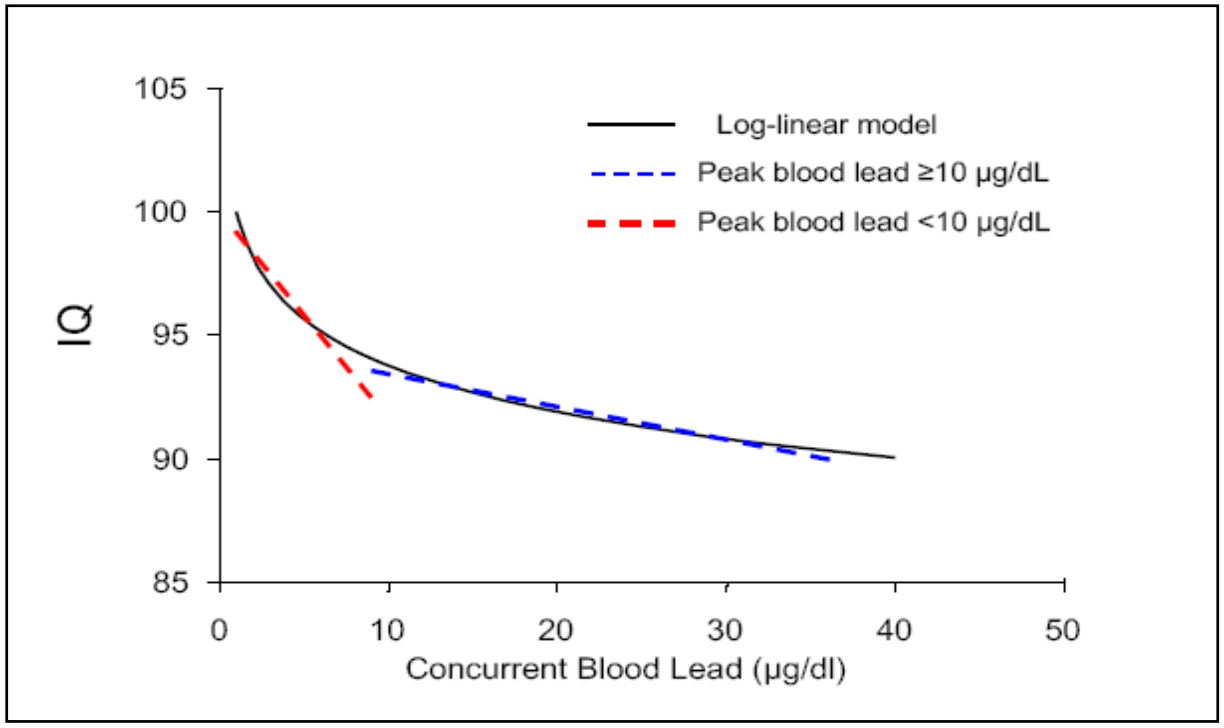
For BLLs ≥ 3.5 mcg/dL, the CDC recommends providers:

- Give anticipatory guidance about common sources of lead exposure and how to prevent exposure.
- Obtain a confirmatory venous sample for capillary results ≥ 3.5 mcg/dL.
- For children with venous BLLs ≥ 3.5 mcg/dL, provide:
  - Venous blood lead monitoring at recommended intervals
  - Follow-up based on BLL.

[1] CDC, Recommended Actions Based on Blood Lead Level

Why Is Under 10 mcg/dL of Concern?

- Levels below 10 mcg/dL are associated with lower IQ scores[1]
- There is an increased rate of loss of IQ at levels less than 10 mcg/dL[2,3]
- IQ can drop 5-8 points with a blood lead increase of 1 to 10 mcg/dL[4,5]



[1] Canfield et al. NEJM 2003; 348(16):1517-26
[2] Bellinger, Current Opinions in Pediatrics, 2008; 20:172-177
[3] Pooled analysis by Lanphear et al. Env Health Persp 2005;113(7):894-899
[4] Confirmed by meta-analysis by Koller et al. EHP, 2004;112(9):987-994
[5] Crump et al, Crit Rev Toxicol, 2013,43(9):785-799

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Environmental Justice Issues in Childhood Lead Poisoning

- Health inequity based on race and income level contributes to increased exposure to environmental hazards, including lead[1,2,3]
- Historically, these sites that may increase exposure to lead have been located in or near low-income housing, and areas with majority non-white populations[4,5,6,7,8,9]
- Examples of these sites include:
  - Industrial and manufacturing sites
  - Power plants and oil refineries
  - Smelters
  - Hazardous waste and battery recycling sites
  - Freeways

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Health Effects of Lead

Absorption and Storage of Lead in Children

- Main absorption in children is gastrointestinal
- Absorption is influenced by iron and calcium
- Approximately 73% of total body lead is stored in bone in children[1]
  - Half-life in blood is about 1 month
  - Half-life in bone is 10-30 years

Lead lines[2] – dense lines at the metaphysis of growing bone. Lead inhibits osteoclasts but not osteoblasts, mainly historical and seen in infants with BLL >50 mcg/dL

[1] ToxGuide for Lead, US Department of Health and Human Services, Agency for Toxic Substances and Disease Registry (ATSDR) accessed at http://www.atsdr.cdc.gov/toxguides/toxguide-13.pdf

[2] Gandhi D, et al, Lead Lines, Lancet, July 2003; 362:197

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Known Effects of Lead Poisoning

- Anemia[1]
- Neurologic System: Neurotoxic[1]
  - Decreased Intelligence Quotient (IQ)
  - Adverse effects on attention and behavior

[1]Bellinger DC, Int J Env Res Public Health, 2011, 8:2593-2628

Known Effects of Lead Poisoning (Cont'd)

- Learning and Behavioral Issues[1]
  - Attention Deficit Hyperactivity Disorder (ADHD)[2,3,4]
  - Behavioral Disorders[5,6,7]
  - Violence and Aggressive Behavior[8,9]
  - Juvenile delinquency[10,11]
  - Elevated school drop-out rate[12]
  - Potential link to criminal behavior[13]
- Neurodegenerative Issues
  - Affects structural brain integrity in midlife with potentially greater risk of neurodegenerative diseases in later life[14]

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Other Disorders Associated with Lead Exposure

- Developmental and Endocrine Disorders
  - Fetal Growth, Intrauterine Growth Retardation (IUGR)[15]
  - Growth, Height, Weight and Body Mass Index[16,17]
  - Reproductive Disorders, Spontaneous Abortion[18,19]
  - Delayed Sexual Maturation[20]
  - Problems with Fertility
- Cardiovascular Disorders
  - Link to childhood[21,22] and adult hypertension[23,24,25,26]
  - Atherosclerosis[24]
  - Cardiovascular mortality[27,28]
  - Cerebrovascular morbidity and mortality[28]

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Other Disorders Associated with Lead Exposure (Cont'd)

- Immunologic Effects[29]
- Renal Disorders
  - Lead nephropathy at high dose[24,29]
- Respiratory Disorders[29]
  - Possible link to obstructive lung changes and asthma (inconsistent findings, more studies needed)
- Adverse dental effects[29]
  - Dental caries (children)
  - Tooth loss (adults)
- Probable Human Carcinogen[29,30]

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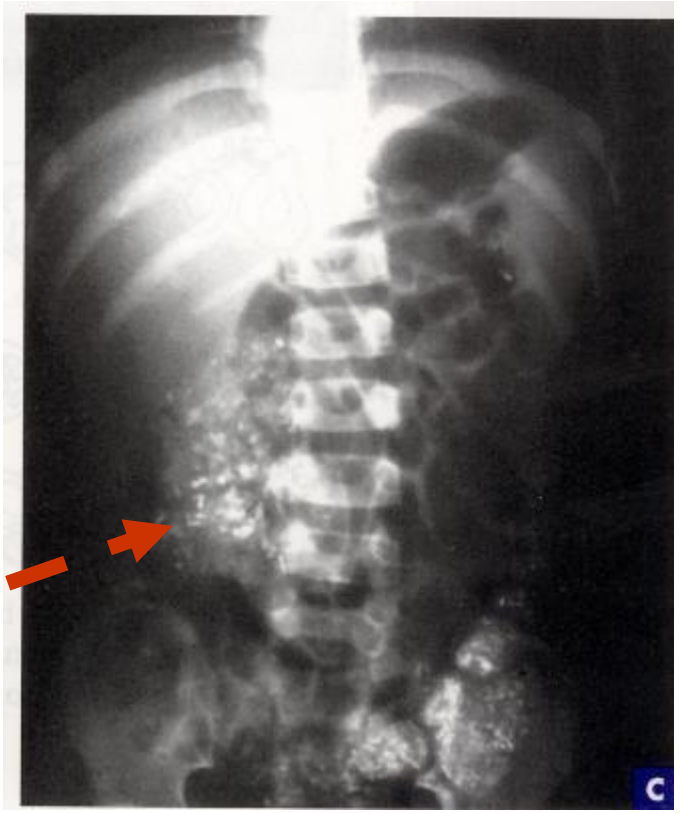
Most Children Today Don't Have Overt Clinical Symptoms

- Earliest clinical signs and symptoms
  - Anemia
  - Anorexia, loss of appetite
  - Abdominal discomfort[1]
  - Constipation[2]
  - Irritability
  - Behavioral Changes

Consider abdominal x-ray (KUB) for radiopacities if BLL over 15 mcg/dL and particulate lead exposure is suspected[3,4]



Case reports:

[1] Cabb, Toxic Remedy, Clin Ped 2008;47(1):77-79

[2] Smith, Constipation, Clin Ped 2007;46(1):83-85

[3] Pediatric Environmental Study Group (PEHSU) AAP. Recommendations on Medical Management of Childhood Lead Exposure and Poisoning, June 2013 Update

[4] American Academy of Pediatrics, Policy Statement, Council on Environmental Health, Prevention of Childhood Lead Toxicity, May 2016, Ped 138(1):1-15, doi: 10:1542/peds.201-1493.

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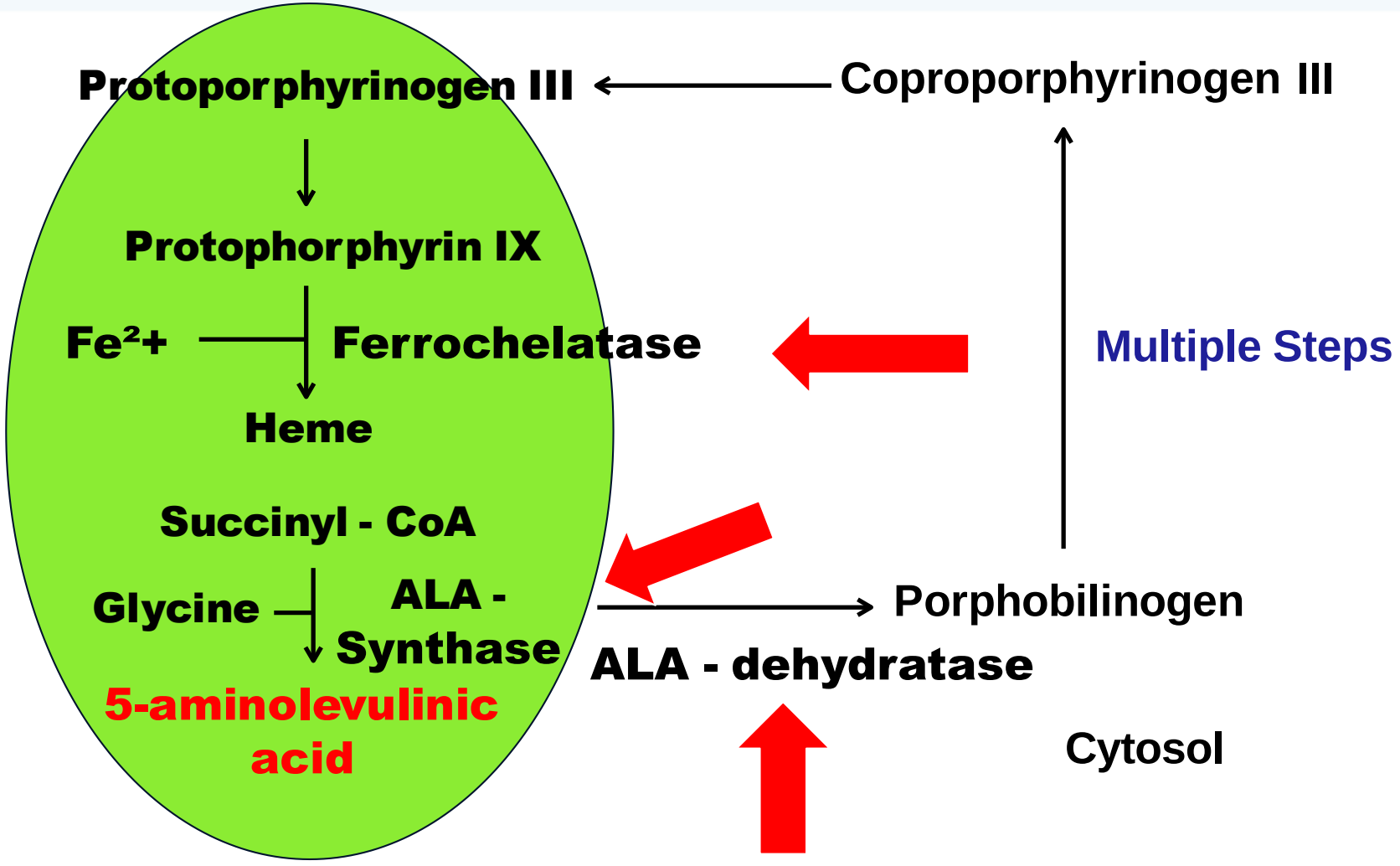
Effects of Lead on the Hematopoietic System

- Microcytic and normocytic anemia
  - Interferes with hemoglobin synthesis and erythrocyte lifespan
  - Increased free erythrocyte protoporphyrin (FEP)
  - Basophilic stippling
- Iron insufficiency leads to more lead absorption
- Iron deficiency anemia often associated with elevated blood lead level[1]

Basophilic Stippling

[1] Wright, et al, J Pediatr, 2003;142:9-14

Lead Interferes with Heme Biosynthesis[1,2]



[1] Alcindor T, et al, Brit J of Haematology, 2002, 116, 733–743
[2] Piomelli S, in "Low Level Lead Exposure: The Clinical Implications of Current Research", HL Needleman, Ed, Raven Press, 1980, pp 67-74

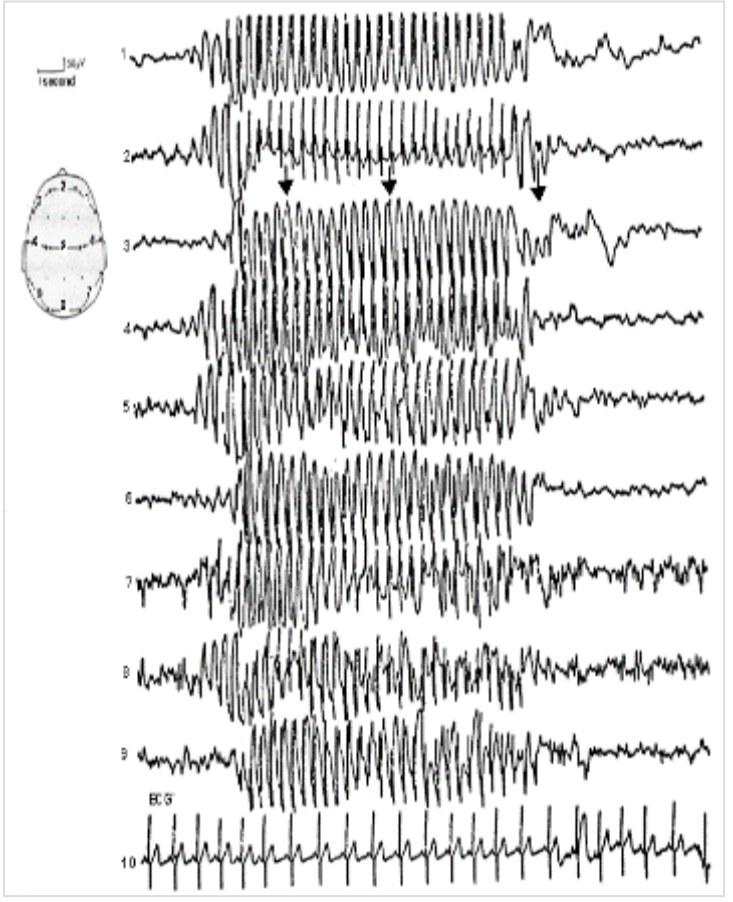
Effects of Lead on the Neurologic System

- Substitutes for calcium in the brain and impairs neurotransmitter and receptor development and function
- Neurologic toxicant
  - Affects mobility and differentiation of neurons during development
  - Creates oxidative stress, alters gene expression
  - Affects early development of blood-brain barrier[1]
    - Increases the risk of toxicants crossing the blood brain barrier
    - Affects critical periods of early brain development
- Reduces development of neurons in first 2 years of life
- Reduces pruning associated with brain maturation

[1]Sanders, T, et al, Rev Env Health; 2009;24(1):15-45

Toxicity - Rare Clinical Signs and Symptoms

- Blood lead over 70 mcg/dL
  - Changes in mentation
  - Encephalopathy
  - Confusion, ataxia
  - Seizures
  - Coma
  - **Death**



Case Report of Death from Lead Poisoning: MMWR 3/23/2006[1]

- Feb 2006: 4-year-old dies in Minnesota of undiagnosed lead poisoning (BLL 180 mcg/dL)[2]
- Child swallowed a charm that came with the sneakers
- No history of pica
- Charm was made of lead
- Reebok recall

[1] Berg et al, MMWR, Death of a Child After Ingestion of a Metallic Charm-Minnesota, 2006

[2] Berkowitz S, Pediatrics, Dec 2006; 118(6): 2548-51

Lead Metabolism in Children is Different Than in Adults

	Children and Adolescents	Adults Age 21 and up
GI Absorption[1,2]	50%	10%
Blood-Brain Barrier	Still developing in infancy and early childhood	Fully formed by adulthood
Bone Storage[3]	~73%	~94%
Bone Resorption	Periods of rapid growth[4] Adolescent pregnancies[5] Periods of bone remodeling such as fractures, prolonged bedrest[6]	Pregnancy[7] Breastfeeding Osteoporosis, Menopause[8] Periods of bone remodeling Accelerated bone turnover (e.g.,bone disease, thyrotoxicosis)

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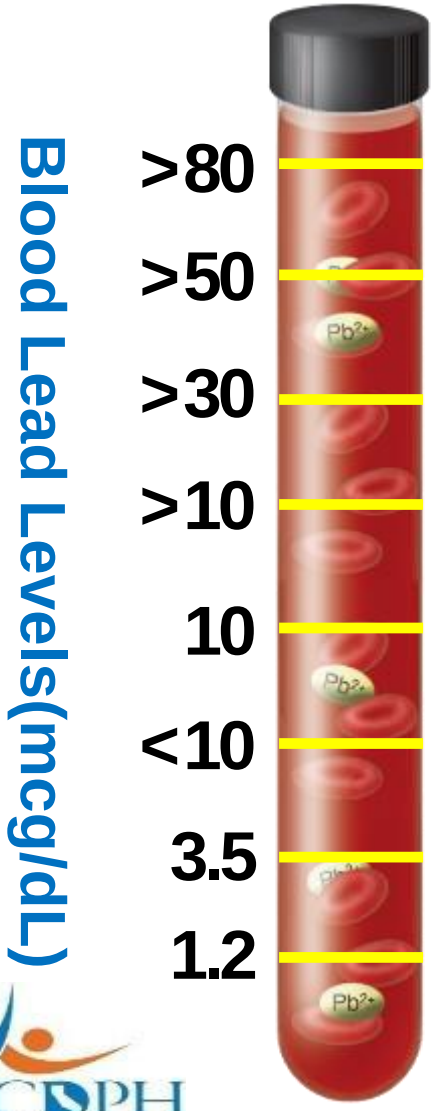
Updated Health Effects of Lead to Support FDA's Closer to Zero Action Plan 2022[1]



- >80 ← Frank encephalopathy, ataxia, tremors, seizure, coma, death
- >50 ← Non-specific symptoms of encephalopathy, lethargy, nausea, vomiting, constipation, weight loss
- >30 ← Alterations in nerve functions
- >10 ← Low birthweight, anemia, decreased hemoglobin synthesis
- 10 ← Altered mood, behaviors, neuromotor and neurosensory functions
- <10 ← Delayed puberty in females
- 3.5 ← **CDC Blood Lead Reference Value**
- 1.2 ← 1 IQ point decrement

[1] Flannery BM, Middleton KB, Updated interim reference levels for dietary lead to support FDA's Closer to Zero action plan, Reg Tox and Pharmacology 133 (2022) 105202

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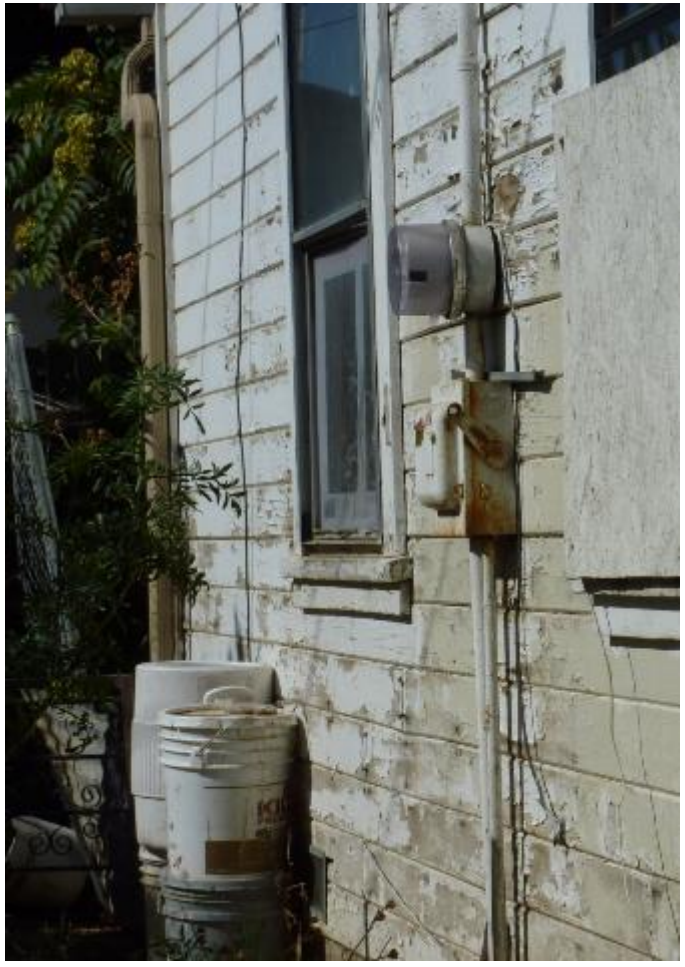
Paint, Dust and Soil Are Still the Most Common Sources of Lead for Children in California

- Young child with capillary blood lead level

  < 5 mcg/dL on routine screening evaluation

  - Venous BLL (VBLL) 86 mcg/dL more than 12 months later when returned for Well Child Check
  - Sent to local Children's Hospital Emergency Department (ED) and admitted for chelation
  - Source: Eating the "walls" – old peeling paint



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Infant with Apnea

- Three-week-old infant brought to local ED
- Signs and symptoms included apnea and eye-rolling episodes
- Infant with VBLL 46 mcg/dL
- Mother's VBLL also 46 mcg/dL
- History of maternal pica (ingestion of imported clay pots during pregnancy)
- Lead readily crosses the placenta during pregnancy

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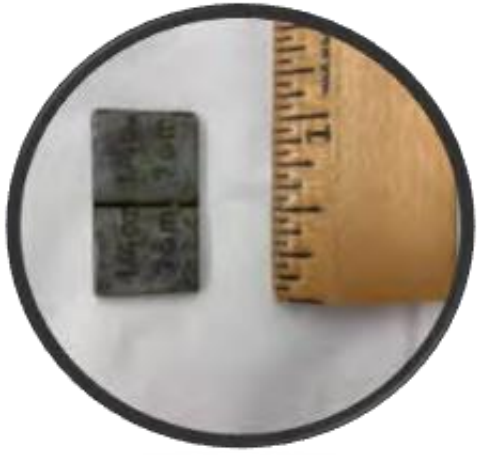
Obtunded and Seizing Toddler

- Toddler with no known history of seizures
- Lethargic, obtunded, recurring seizures
- In Pediatric Intensive Care Unit (PICU), developed encephalopathy and increased intracranial pressure
- Scans suggested cerebellar mass
- Emergency craniotomy performed
- Abdominal x-ray (KUB) after placing nasogastric tube a few days after admission
- Radiopaque mass seen in stomach

Obtunded and Seizing Toddler (Cont'd)

- Rectangular piece of metal found on endoscopy
- VBLL 80 mcg/dL – drawn after finding metal in gastrointestinal tract
- Wheel weight containing 97% lead
- Required IV chelation several times
- Rehabilitation, developmental services
- Source: parent is a mechanic, items stored in garage



Wheel weight 97% lead

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Some Effects of Lead Exposure Potentially Not Identified Until School Age[1,2,3]

- Speech and language delay
- Hearing loss
- Cognitive problems
  - Short-term memory
  - Long-term memory
- Executive function
- Perceptual problems
- Behavioral problems
  - Lack of attention
  - Hyperactivity
  - Impulsiveness

[1] Braun JM et al, Exposures to Environmental Toxicants and Attention Deficit Hyperactivity Disorder in U.S. Children, Env Health Persp 2006;114:1904-1909

[2] Lanphear BP et al, Cognitive deficits associated with blood lead concentrations <10 mcg/dL in US children and adolescents, Public Health Rep 115;(2000):521-529

[3] Lidsky TI, Schneider JS, Lead neurotoxicity in children: basic mechanisms and clinical correlates, Brain (2003); 126:5-19

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Some Studies on Educational Impact of Lead Exposure in Children[1]

Blood Lead Levels	Educational Impact	Size of Study	Location of Study
≤ 3 mcg/dL	Decreased end of grade test scores	More than 57,000 children	North Carolina (Miranda et al. 2009)
4mcg/dL at 3 years of age	Increased likelihood learning disabled classification in elementary school	More than 57,000 children	North Carolina (Miranda et al. 2009)
	Poorer performance on tests	35,000 children	Connecticut (Miranda et al. 2011)

[1] CDC, Educational Interventions Affected by Lead

Who is at Risk for Lead Exposure?

Children at Higher Risk for Lead Exposure

- Toddlers 1-2 years old due to increased hand-mouth behavior
- Children in publicly funded programs for low-income children
  - Medi-Cal
  - Child Health and Disability Prevention Program (CHDP)
  - Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)
  - Supplemental Nutrition Assistance Program (SNAP)
  - Head Start
- Children living in or spending a lot of time in pre-1978 buildings

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Children and Teens at Risk

Children and teens with:

- Pica
- Sibling, playmate or other close contact with an increased lead level
- History of living in or visiting country with high levels of environmental lead
- Hobby or occupational exposure to lead, including take-home lead
- Suspected lead exposure

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Other Risk Factors for Increased Lead Exposure

- Children with neurodevelopmental or other medical conditions that are associated with behaviors that increase lead exposure risk
  - Developmental delay
  - Autism/Autism Spectrum Disorder (ASD)
  - Sickle cell disease
- May need blood lead testing/monitoring even after 24 months of age

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Sources of Lead Exposure

Routes of Exposure

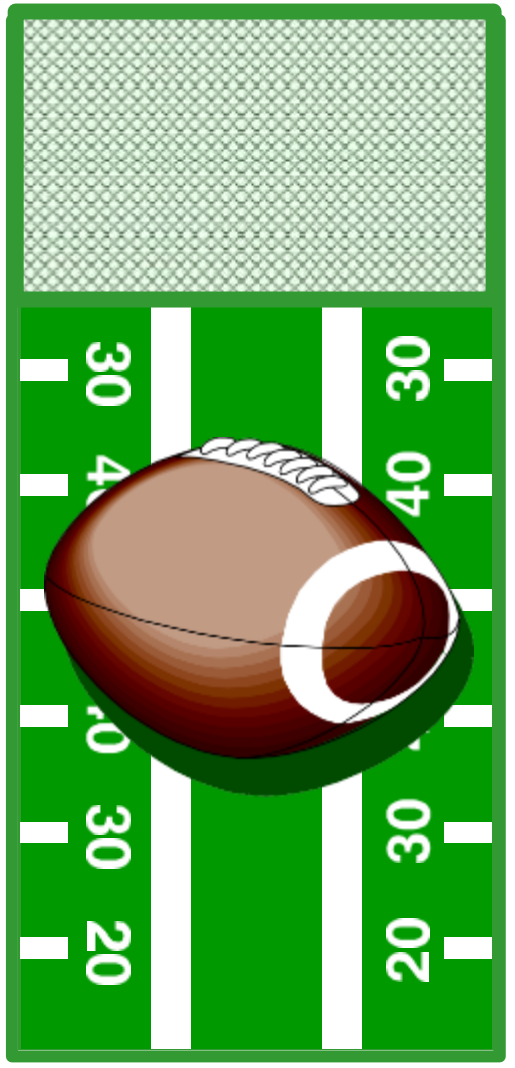
- Oral and Hand-to-Mouth
- Respiratory
- Transplacental & Breast Milk
- Dermal
- Retained Bullets

The Common Sources of Lead are Environmental

- Deteriorated lead-based paint
  - Cracking, flaking, peeling
- Lead-contaminated dust
- Lead-contaminated soil
- Dust and soil lead from use of leaded gasoline, paint and other airborne sources

How Much Lead is of Regulatory Concern?

- 1 gram packet of lead dust spread over 10,000 square feet (ft^2) = 100 mcg/ft^2
- Current EPA action level: 10 mcg/ft^2 of indoor floor dust
- FDA maximum daily dietary intake for lead (Interim Reference Level):[1,2]
  - 2.2 mcg per day for children
  - 8.8 mcg per day for females of childbearing age



[1] FDA, Closer to Zero: Action Plan for Baby Foods
[2] Flannery BM, Middleton KB, Updated interim reference levels for dietary lead to support FDA's Closer to Zero action plan, Reg Toxicology and Pharmacology 133(2022)105202

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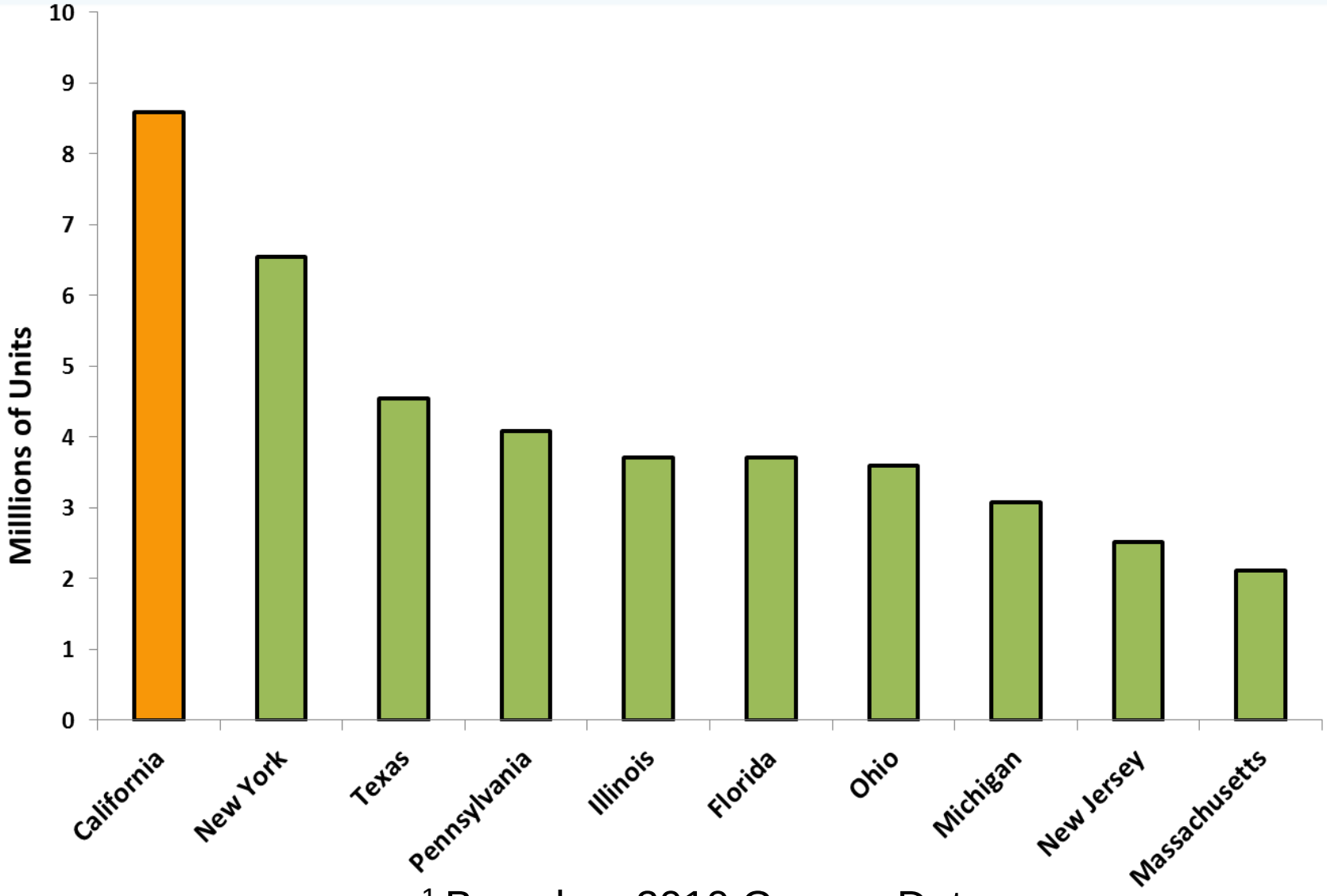
Older Housing More Likely to Have Lead-Based Paint: Top Ten States in U.S. with Pre-1980 Housing[1]



[1] Based on 2010 Census Data

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Leaded Gasoline

- Lead removed from gasoline for on-road vehicles in the 1990s in the U.S.
- Leaded gasoline still used for small aircraft (avgas)[1,2,3]

[1] USEPA, EPA Takes Final Step in Phaseout of Leaded Gasoline, EPA Press Release, January 29, 1996
[2] Federal Register, 40 CFR Part 80, Sect 1C, Vol 61, No. 23, February 2, 1996 pg 3834, govinfo.gov/content/pkg/FR-1996-02-02/pdf/96-2231.pdf#page=6 accessed 4-08-2021
[3] Federal Aviation Administration (FAA), Aviation Gasoline: About Aviation Gasoline

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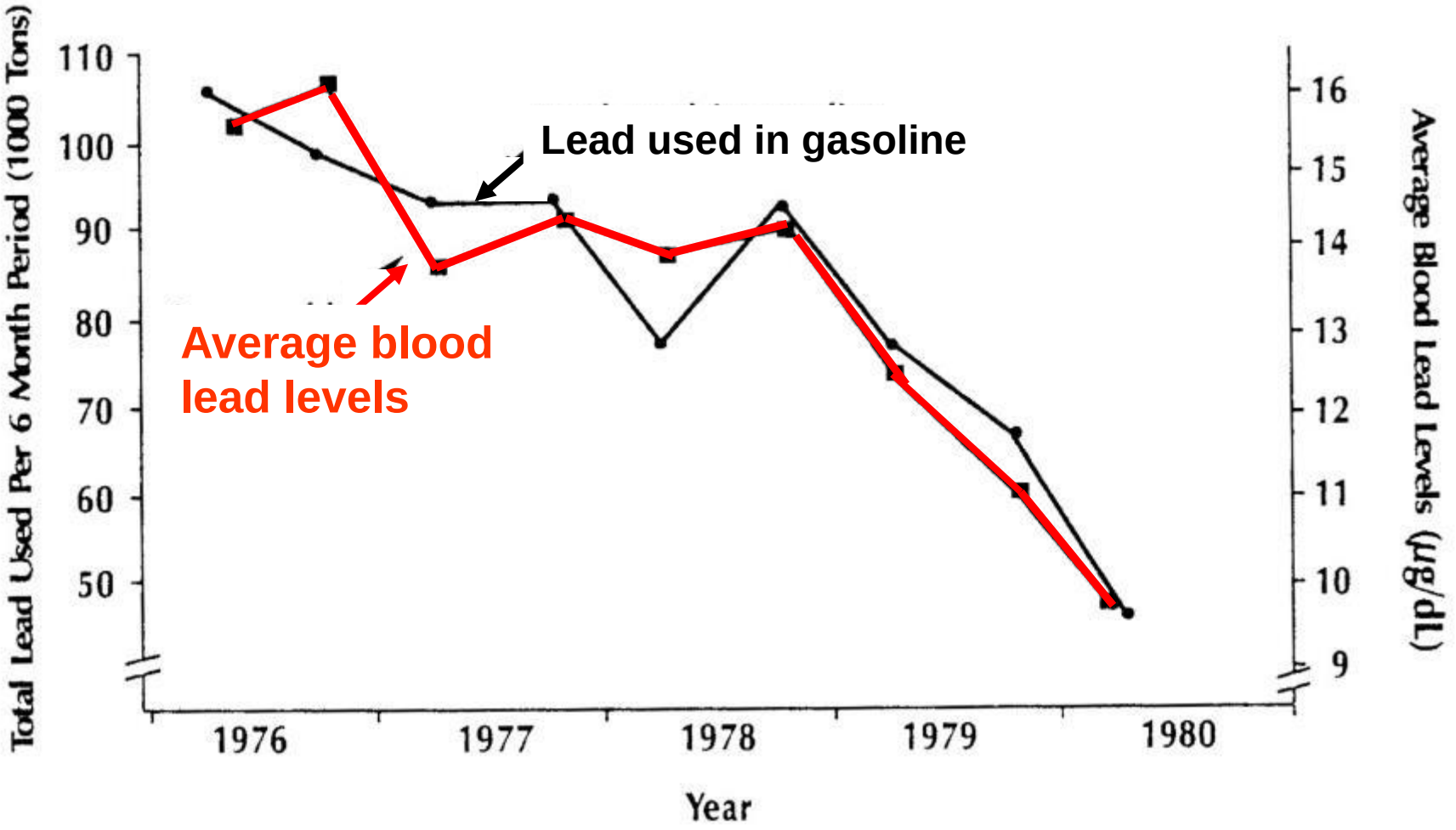
Change in Blood Lead Levels in Relation to Decline in Use of Leaded Gasoline in On-Road Vehicles 1976-1980



Annest JL, et al, NEJM 1983;308(23):1373-1377
Fergusson JE, Sci of the Tot Env 1986;50(1968):1-54

Lead in Soil Remains

Lead in Drinking Water

- Pre-1986 housing more likely to have lead in pipes, fittings, solder, fixtures and faucets[1]
- Lead and Copper Rule (1991) prohibited lead pipe for residential use and set a federal action level of 15 ppb for drinking water[2]
- EPA is considering long term revisions to the Lead and Copper Rule[3]

[1] US EPA, Safe Drinking Water Act (SDWA): A Summary of the Act and Its Major Requirements, pg 12

[2] US EPA, Lead and Copper Rule

[3] US EPA, Lead and Copper Rule Long-Term Revisions

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Lead in Water in Schools and Child Day Care Centers

- AB2370 – Requires licensed child day care centers in buildings constructed before January 1, 2010 to have drinking water tested for lead.
  - Written directive issued July 28, 2021
    - California Action Level for lead in water at child care centers set at 5 ppb.
    - Testing requirements do not apply to Family Child Care homes.
  - Child care provider information about AB 2370
- AB746 – Community water systems must test for lead in educational buildings constructed before January 1, 2010 prior to January 1, 2019.
  - California Division of Drinking Water - Lead Sampling of Drinking Water in California Schools

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California Lead Service Line Replacement

- Service lines that contain lead are called lead service lines.
- Over the next ten years, California public water utilities are replacing lead service lines that they own.
- Further information can be found at: CLPPB, Lead Service Line Replacement

Potential Lead Service Line

Steps to Help Reduce Any Potential Exposure to Lead in Tap Water

- Always use water from the cold tap for drinking or cooking.
- If water needs to be heated, draw water from the cold water tap and heat the water on the stove, teapot or in the microwave.
- Let the water run for at least 30 seconds prior to using it for drinking or cooking.
- If the household water has not been used for 6 hours or more, let the water run for a longer period of time (1 to 5 minutes until the water feels cold).
- Set this water aside for non-potable uses (e.g., cleaning, houseplants).
- Consider using a water filter certified to remove lead.
  - EPA, A Consumer Tool for Identifying Point of Use (POU) Drinking Water Filters Certified to Reduce Lead
- Well water should be tested before use.
  - US EPA, Private Drinking Water Wells

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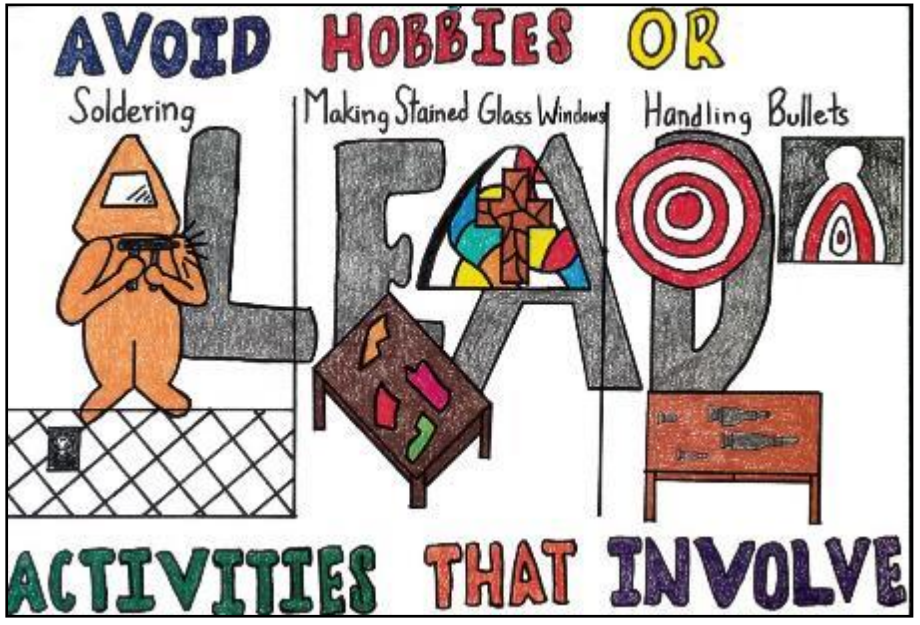
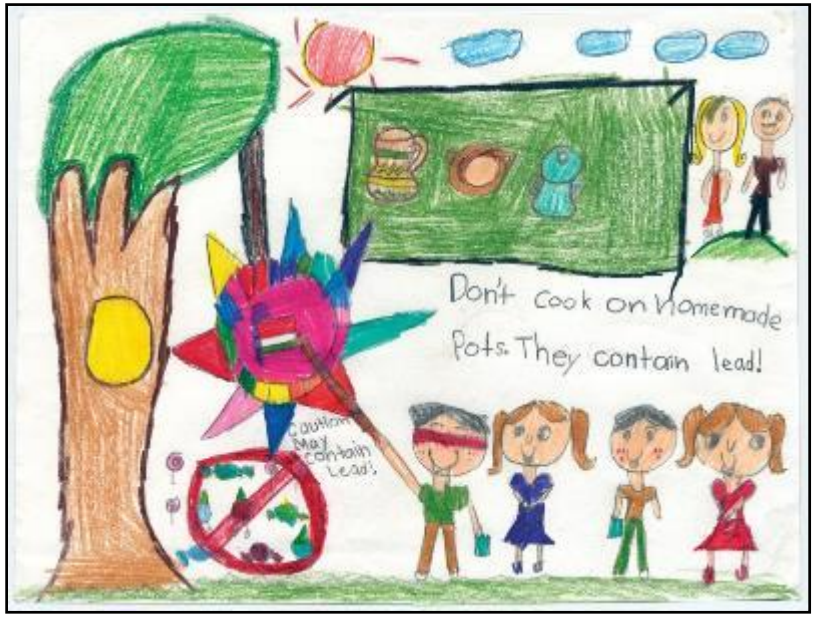
Other Sources of Lead are Important Lead Exposure is Cumulative





Examples of Sources of Lead

- Occupational Sources
- Pica
- Hobbies
- Ceramics
- Leaded Crystal
- Ceramic Water Crocks
- Artist's Paint
- Consumer Products
- Traditional Remedies
- Traditional Creams and Cosmetics
- Candy
- Spices
- Baby Food
- Metal Objects
- Aluminum Pots

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Some Examples of Occupational Sources Brought Home (Take-Home Lead)

- Construction/painting/remodeling/ abatement
- Smelting/soldering/metal working
- Storage battery production
- Firing ranges
- Recycling centers (battery, e-waste, scrap metal)

Education and outreach resources available at:
Occupational Lead Poisoning Prevention Program

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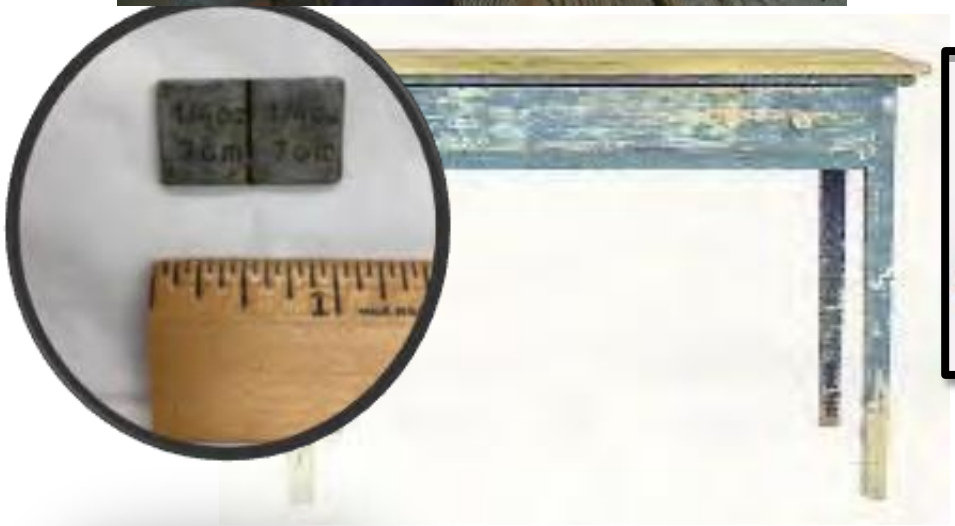
Pica

- Children, adolescents, and pregnant women have been known to eat dirt, clay, paint chips, plaster, lead pellets, fishing sinkers, among other things.
- Some cultural traditions include eating dirt and clay.[1]
- Pica has been associated with iron deficiency.[2]

[1] Callahan GN, Emerging Infectious Diseases: Eating Dirt
[2] Howarth D, AFP, 2013;42(5):299-300

Some Activities or Hobbies That May Increase Risk of Lead Exposure

- Furniture painting/refinishing
- Glazing, pottery making
- Soldering
- Fishing (lead sinkers)
- Collectibles
- Firearms
- Stained glass
- Jewelry making
- Balancing tires (lead wheel weights)



Lead in Ceramics & Crystal[1,2]

24-hour leach results:
13 mcg/mL =
3,250 mcg in 250 mL

[1]Lynch, R, J Environ Health, May 2008
[2]Villalobos, M, et al, Sci Tot Env, Apr 2009

Some Cookware May Contain Lead Including Cookware Brought to U.S. by Refugees

Samovar[1] Purchased Overseas

- Unboiled water after:
  - 15 minutes in Samovar
    - 1,000 mcg/250 ml

From Afghanistan* [2,3]

- Leachate after:
  - 15 min boiling
    - 89.8 mcg/250 ml
  - 24 hrs in pot after boiling
    - 315 mcg/250 ml

*Photos Courtesy: Stephen G. Whittaker, Katie M. Fellows, Hazardous Waste Management Program, King County, WA

References Slide 234

Aluminum Cookpots as a Source of Lead Exposure in Afghan Refugee Children Resettled in the United States[2,3]

Purchased in United States*

- Leachate after:
  - 15 minutes boiling
    - 3.5 mcg/250 ml
  - 24 hours in pot after boiling
    - 530 mcg/250 ml

Purchased Online*

- Leachate after:
  - 15 minutes boiling
    - 71 mcg/250 ml
  - 24 hours in pot after boiling
    - 1,943 mcg/250 ml

*Photos Courtesy: Stephen G. Whittaker, Katie M. Fellows, Hazardous Waste Management Program, King County, WA

References Slide 234

Lead in Folk Remedies

Pay-loo-ah
up to 21,000 ppm
(example)

- Azarcon and Greta in the Latin American community
- Some Ayurvedic medicines
- Bright colored powders (e.g., pay-loo-ah) in South Asian community
- Some herbal remedies
- Some patent remedies in the Chinese community

Azarcon, Greta
up to 900,000 ppm lead
(example)

Ayurvedic medicines
330,000 ppm lead
(example)

Learn About Lead in Folk Remedies

Traditional Cosmetics and Remedies May Contain Other Heavy Metals

Skin lightening creams may contain mercury.
2019 - Organic mercury added to skin cream caused severe neurologic sequelae.[1]

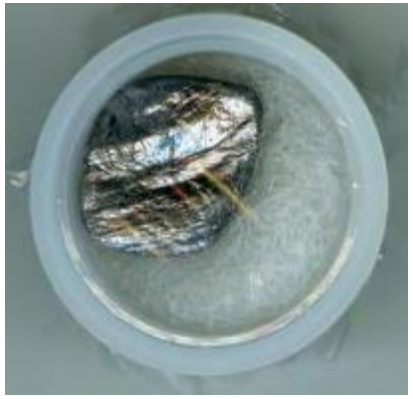
Many Ayurvedic and other traditional remedies contain heavy metals such as arsenic, mercury, cadmium, and lead.[2,3,4,5,6,7]

References Slide 233

Lead in Traditional Creams and Cosmetics

Kohl, Surma, Kajal

- Up to 870,000 ppm lead
- Applied to eyes in children
- May be applied to umbilical stump



Surma Rock

- 517,000 ppm lead
- Ground up to make surma

Facial Cream from China

- 97,000 ppm lead
- Applied to mother and transferred from mother to child

Vietnamese Diaper Cream

- Up to 9670 ppm lead
- Two cases identified by Oregon Health Authority Jan 2023
- FDA recall Feb 2023

CDC, MMWR, Childhood Lead Exposure Associated with the Use of Kajal, an Eye Cosmetic from Afghanistan — Albuquerque, New Mexico, 2013

FDA, Shop Me Ca Recalls “Diep Bao Cream” Because of Possible Health Risk

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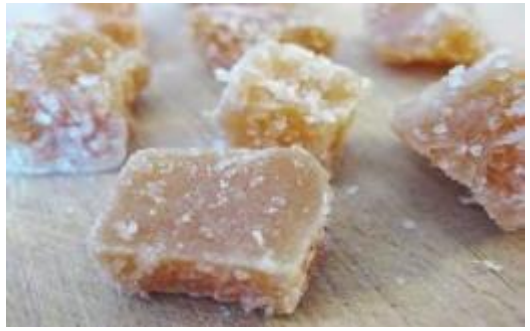
California: Lead in Candy

- Maximum allowable lead in candy in California is 0.1 ppm. (AB121, 2005)
- CCR Title 27, Section 28500 established a naturally occurring level of lead in candy flavored with chili and/or tamarind of 0.02 ppm.
- Results from California Food and Drug Branch (FDB) testing available at: CDPH, FBD, Lead in Candy

Tamarind Candy[4]



Crystallized Ginger[1]

Dried Plum Candy[2]

Candy with Chili Powder[3,5]

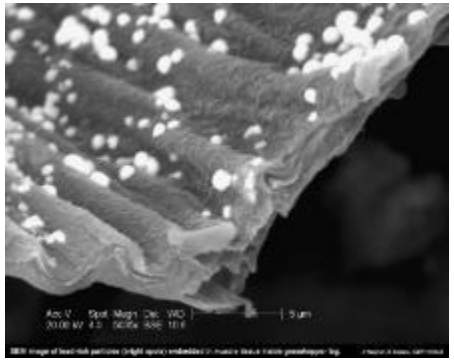
References Slide 235

Imported Spices and Other Foods May Contain Lead[5]

- Turmeric
  - up to 11,000 ppm lead
- Khmeli Suneli[1] – Georgian Spice
  - over 20,000 ppm lead
- Chapulines[2,3]
  - up to 6,400 ppm lead

Turmeric

Khmeli Suneli



4

[1] CDPH, CDPH Warns Consumers not to Eat Khmeli Suneli Spice Blends sold in Certain Stores in Los Angeles County

[2] Handley MA, et al, AJPH 2007;97(5):900-906

[3] Villalobos, M, et al, Sci Total Environ. 2009;407(8):2836-2844

[4] Photomicrograph Courtesy: Jeffrey Wagner, EHLB

[5] Results per CDPH, Environmental Health Laboratory Branch

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Heavy Metals in Baby Food[1,2,3,4]

- Heavy metals, including arsenic, lead, cadmium, and mercury were found in baby food and juices.
- Most reported lead results were for ingredients.
  - Potential lead exposure from the final product could not be determined for these.
- Lead levels up to 641 ppb (0.641 mcg/g) were reported for some final baby food products.
- This could result in ingestion of more than 2.2 mcg of lead per day (the FDA Interim Reference Level (IRL) for children), depending on the quantity consumed.
- The U.S. Food and Drug Administration's (FDA) plan, Closer to Zero, identifies actions the agency will take to reduce exposure to arsenic, lead, cadmium, and mercury from foods eaten by babies and young children—to as low as possible.

References Slide 236

Other Potential Sources for Older Children and Teens

- Working or spending time at a firing range
- Working in an auto shop with older model cars
- Working in painting or construction
- Hobbies such as sharpshooter, stained glass, pottery, painting, jewelry making

- Pica – Eating items such as pots, dirt, chalk, plaster, clay, or leaded pottery glazes

California's Childhood Lead Poisoning Prevention Provider Screening Mandates and Recommendations

Informing Requirements for California Health Care Providers

- Provide **anticipatory guidance** about lead at each periodic assessment from 6 months to 6 years
- Health care providers who perform periodic health assessments for children are required to **inform** parents and guardians about:
  - The risks and effects of childhood lead exposure
  - The requirement that children in Medi-Cal should be blood lead tested
  - The requirement that children not in Medi-Cal who are at high risk of lead exposure should also be blood lead tested

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California Assessment and Testing Mandates

- **Blood lead test:** All children in publicly supported programs such as Medi-Cal, Women, Infants and Children (WIC), and CHDP at both 12 months and 24 months of age.[1]
- **Assess:** If child is not in a publicly supported program, at both 12 months and 24 months of age:
  - Ask: "Does your child live in, or spend a lot of time in, a place built before 1978 that has peeling or chipped paint or that has been recently remodeled?"
  - **Blood lead test if the answer to the question is "yes" or "don't know."**
- Blood lead test if a change in circumstances has put child at risk of lead exposure.

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Catch-Up Testing Mandates

- If **either** of these mandates is missed:

  A. Blood lead testing of children in publicly funded programs for low-income children **or**

  B. Assessment and testing of at-risk children not in these programs **then**

- Catch-up testing (A) **or** assessment and testing (B) is required:
  - When missed at 12 months of age, catch-up is mandated between 12 and 24 months of age.
  - When missed at age 24 months or later, catch-up is mandated for children ages 24 months to 72 months.

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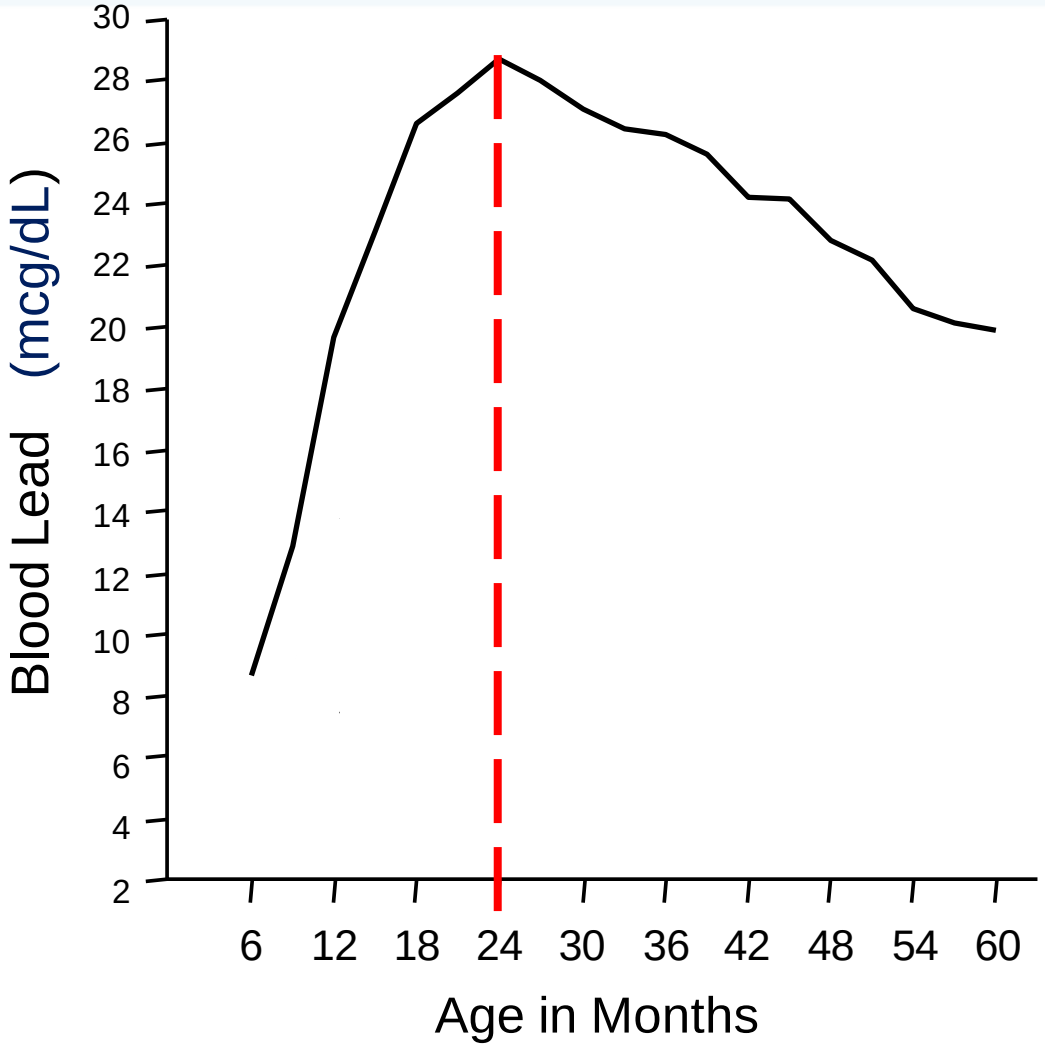
Mean Blood Level by Child's Age



Dietrich et al. Neurotoxicol Teratol 1993;15(1):37-44

BLL Screening Caveats

- Measured on whole blood; reported in micrograms per deciliter (mcg/dL)
- Venous blood sample is the gold standard
- Capillary draw acceptable as initial screen
  - Follow recommendations for best practices when collecting a capillary blood sample for lead testing (poster)
  - Mission Unleaded: How to test children for lead with maximum accuracy (video)
  - CDC recommends venous confirmation of capillary BLLs ≥ 3.5 mcg/dL
- Venous sample sent to a reference lab required for follow-up testing
- CLPPB: Blood Lead Testing fact sheet
- CDC: LeadCare® Expanded Recall (October 2021) Questions & Answers

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Filter Paper (Dried Blood Spots (DBS))[1,2]

- Multiple issues of possible contamination during:
  - Paper production
  - The collection and drying of the blood spot on the filter paper.
- Unequal blood distribution which can result in false positives or false negatives when the paper is punched for analysis.
- These issues become of greater significance with the lowering of the BLRV.

[1] CDC: LeadCare® Expanded Recall (October 2021) Questions & Answers

[2] Parsons, PJ et al, A Critical Review of the Analysis of Dried Blood Spots for Characterizing Human Exposure to Inorganic Targets Using Methods Based on Analytical Atomic Spectrometry, J Anal At Spectrom 2020, 35:2092-2112

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Filter Paper Blood Lead Testing (Cont'd)

- If you are currently using filter paper testing, please discontinue its use. If you have used filter paper testing in the past to test children under age 6:
  - If the test result was less than 3.5 mcg/dL, repeat the test with
    - EITHER *capillary blood and an FDA-approved Point of Care testing device*
    - *OR capillary or venous blood sent to a lab*
  - If the filter paper result was equal to or greater than 3.5 mcg/dL,
    - Repeat with a venous test
    - Send the blood sample for analysis to a reference lab that runs either
      - Inductively coupled plasma mass spectrometry (ICP-MS) or
      - Graphite furnace atomic absorption spectrometry (GFAAS)

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AB 2276 – Requirements for Medi-Cal Managed Care Plans

Beginning January 1, 2021, when there is a contract between the Department of Health Care Services (DHCS) and a Medi-Cal managed care plan, the Medi-Cal managed care plan is required quarterly to:

- Identify every enrollee who is a child without a record of completing the required blood lead screening tests.
- Remind the contracting network provider of the requirement to perform the required blood lead screening tests.
- Remind the contracting network provider of the requirement to provide the oral or written anticipatory guidance to a parent or guardian relating to risk of childhood lead poisoning.
- Ensure signed statement of voluntary refusal is documented in the child enrollee's medical record if required blood lead screening test is refused.

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AB 2326 Laboratory Reporting

- **These changes apply to all laboratories including POC laboratories, in California.**
- *Blood lead results greater than or equal to the most recent CDC reference level is required to be reported within 3 working days of analysis and if the result is less than the CDC reference level, the result is required to be reported within 30 calendar days of analysis.*

- Beginning July 1, 2023, HSC Section 124130: The analyzing laboratory shall report all of the following:
- The test results in micrograms of lead per deciliter. The testing methodology used for blood lead analysis specified as point of care, inductively coupled plasma mass spectrometry, graphite furnace atomic spectroscopy, or other.
- The name, birthdate, address of the person tested, including zip code and telephone number, sex, race and ethnicity, and pregnancy status.

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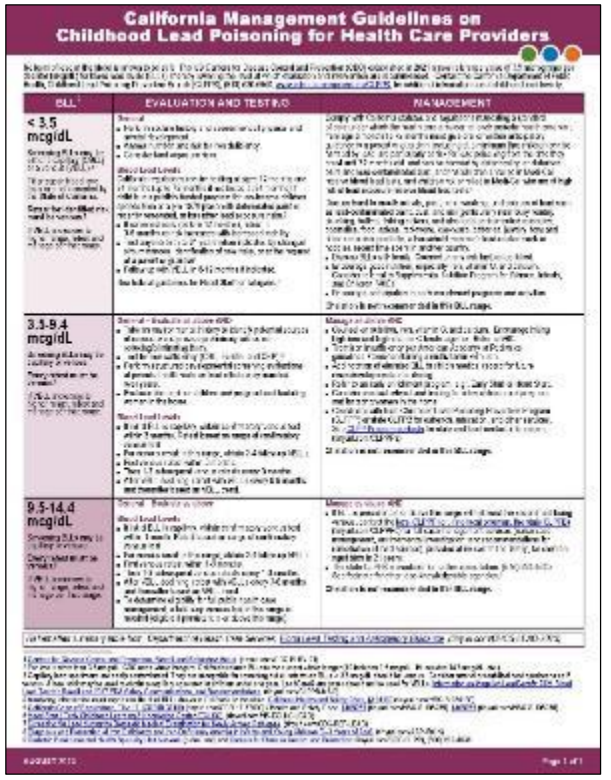
AB 2326 Laboratory Reporting[1] (Cont'd)

- The name, address, telephone number, and National Provider Identifier (NPI) of the health care provider that ordered the analysis.
- The name, address, telephone number, Clinical Laboratory Improvement Amendments (CLIA) number, and NPI of the analyzing laboratory. The name, address, telephone number, and CLIA number of the referring laboratory, if any.
- The accession number and the date the specimen was drawn. The date the analysis was performed. The source of the specimen, specified as venous, capillary, arterial, cord blood, or other.
- The person's Medi-Cal client identification number (CIN) or, for other health plans, the name of the health plan and the medical plan identification number.
- The name, address, telephone number of the person's employer, if any.

[1] Bill Text: AB 2326

California Management Guidelines on Childhood Lead Poisoning for Health Care Providers

- California Management Guidelines:
- Provide summary testing and follow-up recommendations.
- Testing and follow-up recommended for all children with BLLs ≥ 3.5 mcg/dL (the CDC BLRV).
- Apply to all physicians, physician assistants, and nurse practitioners caring for California children.



- More detailed information about the guidelines can be found at:

2023 Blood Lead Testing and Anticipatory Guidance.pdf (ca.gov)

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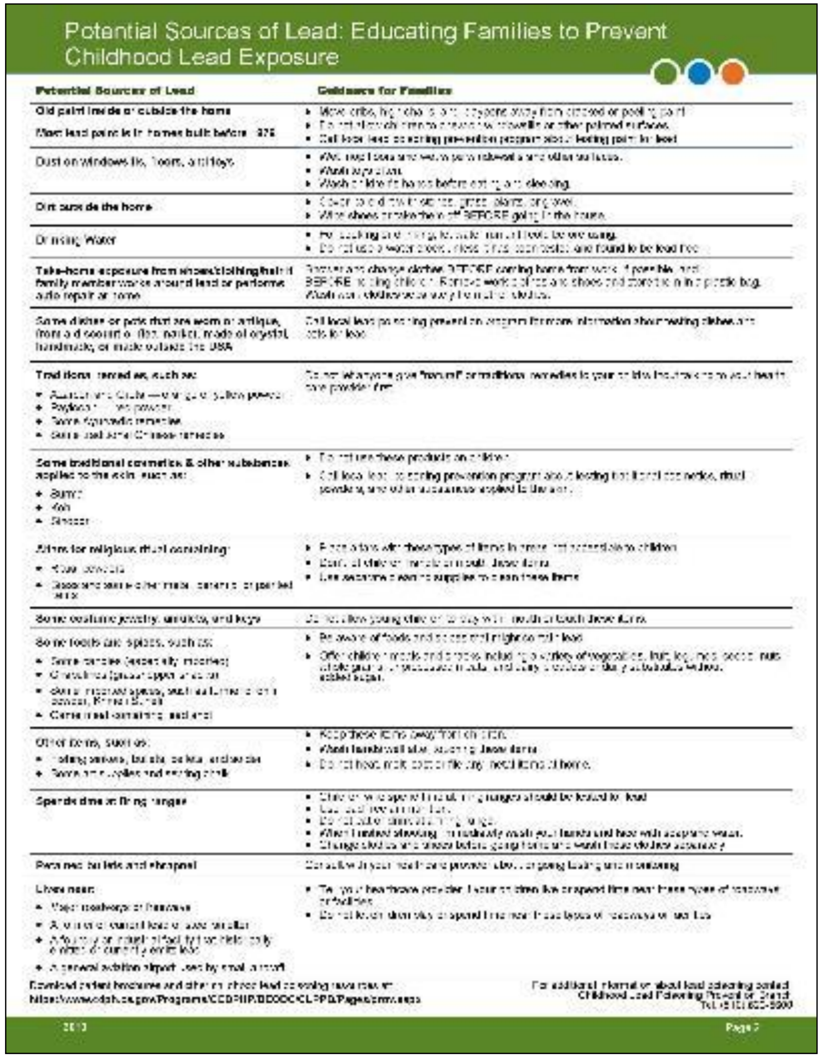
Other Indications for a Blood Lead Test[1]

- Parental request
- Sibling, playmate, or other close contact with an increased blood lead level
- Suspected lead exposure (see possible sources of exposure)
- History of living in or visiting country with high levels of environmental lead


Potential Sources of Lead: Educating Families to Prevent Childhood Lead Exposure

[1] Not currently in regulations but also should be considered

Re-testing timelines by BLL[1] < 3.5 mcg/dL (Current CDC BLRV)

Tests and Retests	
• Screening BLLs may be either capillary (CBLL) or venous (VBLL). • Filter paper blood lead tests are not accepted by the State of California.	• If tested before 12 months, re-test in 3-6 months as risk increases with increased mobility. • VBLL test anyone birth to 21 years when indicated due to known or suspected lead exposure. • Follow-up with VBLL in 6-12 months if indicated.

[1] California regulations require testing at **both** ages 12 months and 24 months (up to 72 months if not tested at 24 months) if child is in a publicly funded program for low-income children, spends time at a pre-1978 place with deteriorated paint or that has been recently renovated, or has other lead exposure risks.

Re-testing timelines by BLL 3.5*–9.4 mcg/dL

Retesting for Initial CBLL	Retesting for Initial VBLL	VBLL monitoring once declining
• Obtain confirmatory VBLL within 3 months. • Retest based on range of confirmatory VBLL.	• Obtain 2-4 follow-up VBLLs. • First venous retest within 3 months. • Then 1-3 subsequent venous retests every 3 months.	• VBLL retest every 6-9 months and thereafter based on VBLL trend.

*Per CDC BLRV

Re-testing timelines by BLL 9.5–14.4 mcg/dL

Retesting for Initial CBLL	Retesting for Initial VBLL	VBLL monitoring once declining
• Obtain confirmatory VBLL within 1 month. • Retest based on range of confirmatory VBLL.	• Obtain 2-4 follow up VBLLs. • First venous retest within 1-3 months. • Then 1-3 subsequent venous retests every 1-3 months.	• VBLL retest every 3-6 months and thereafter based on VBLL trend.

Re-testing timelines by BLL 14.5–19.4 mcg/dL

Retesting for Initial CBLL	Retesting for Initial VBLL	VBLL monitoring once declining
• Obtain confirmatory VBLL within 1 month. • Retest based on range of confirmatory VBLL.	• Obtain 2-4 follow up VBLLs. • First venous retest within 1-3 months. • Then 1-3 subsequent venous retests every 1-3 months.	• VBLL retest every 3-6 months and thereafter based on VBLL trend.

Re-testing timelines by BLL 19.5–44.4 mcg/dL

Retesting for Initial CBLL	Retesting for Initial VBLL	VBLL monitoring once declining
• Obtain confirmatory VBLL within 2 weeks. • Retest based on range of confirmatory VBLL.	• Obtain 2-4 follow up VBLLs. • First venous retest within 1-4 weeks (the higher the BLL, the sooner the retest). • Then 1-3 subsequent venous retests every 2-4 weeks.	• VBLL retest every 1-3 months and thereafter based on VBLL trend.

Re-testing timelines by BLL

BLL	Confirmatory VBLL	VBLL monitoring
44.5-59.4 mcg/dL	WITHIN 48 HOURS	• Monitor response to chelation with VBLLs. • Follow-up with VBLLs every 2-4 weeks (more frequently if status requires) until trend is downward or stable or as trend indicates.
59.5-69.4 mcg/dL	WITHIN 24 HOURS	
≥ 69.5 mcg/dL	IMMEDIATELY	

Additional Considerations for BLLs ≥ 44.5 mcg/dL

- **Expedite confirmatory VBLL** to validate accuracy of initial BLL.
- If initial CBLL ≥ 44.5 mcg/dL and confirmatory VBLL < 3.5 mcg/dL, a repeat VBLL in 2-4 weeks is recommended. Sooner if symptomatic or probable lead exposure, in order to rule out possible false negative.
- Obtain confirmatory VBLL result, obtain KUB, and complete other medically appropriate actions BEFORE initiating chelation.
- Consult with a medical toxicologist or pediatric hematologist experienced in managing chelation regarding initiation of chelation before confirmatory test result is available in a symptomatic child.
- If child symptomatic with altered mental status, seizing or appears toxic, do not withhold chelation therapy awaiting confirmatory VBLL.
- Consider modifying protocol if VBLLs are not decreasing as expected or remain chronically elevated, e.g., from a retained bullet.

Evaluation and Management
< 3.5 mcg/dL (Current CDC BLRV)

Evaluation	Management
• Perform routine history and assessment of physical and mental development. • Assess nutrition. • Assess risk for iron deficiency. • Consider lead exposure risks.	• Mandated anticipatory guidance at each periodic visit age 6 to 72 months. • Discuss hand to mouth activity, pica, hand washing, sources of lead. • Counsel on any risk factors identified. • Encourage good nutrition, especially iron, vitamin C, and calcium. • Consider referral to WIC. • Encourage participation in early enrichment programs and activities. • Chelation is not recommended in this BLL range.

Evaluation and Management for VBLL 3.5-9.4 mcg/dL

Evaluation	Management
• **Evaluate as for < 3.5 mcg/dL AND** • Take an environmental history. • Test for iron sufficiency (CBC, Ferritin, CRP). • Perform structured developmental screening at periodic health visits.	• **Manage as for < 3.5 mcg/dL AND** • Counsel on nutrition, iron, Vitamin C, and calcium. • Treat iron insufficiency per AAP guidelines. • Consider starting a multivitamin with iron. • Add notation of elevated BLL to child's medical record.

Evaluation and Management for VBLL 3.5-9.4 mcg/dL (Cont'd)

Evaluation	Management
• Evaluate risk to other children and pregnant and lactating individuals in the home.	• Refer to an early enrichment program, e.g., Early Start or Head Start. • Consider medical referral and testing for other children and pregnant and lactating individuals in the home. • Refer to WIC, if eligible. • Coordinate with local CLPPP or state CLPPB for outreach, education, and other services.[1] • Chelation is not recommended in this BLL range.

[1] www.cdph.ca.gov/programs/CLPPB

Evaluation and Management for VBLL 9.5-14.4 mcg/dL

Evaluation	Management
• **Evaluate as for 3.5-9.4 mcg/dL** • To determine eligibility for full public health case management, retest with a VBLL. • Eligible if persistent in or above this range.	• If BLL is persistent in or above this range, contact the local CLPPP (or, if no local program, the state CLPPB)[1]. • If eligibility confirmed, family will receive full public health case management services, including nursing visit, environmental investigation, and follow-up for children age birth to 21 years. • Chelation is not recommended in this BLL range. • The state CLPPB is available for further consultation (510-620-5600). See footnote for other knowledgeable agencies.[2]

[1] www.cdph.ca.gov/programs/CLPPB

Evaluation and Management for VBLL 14.5-19.4 mcg/dL

Evaluation	Management
• **Evaluate as for 9.5-14.4 mcg/dL AND** • Consider abdominal X-ray if suspected ingestion of leaded materials, history of pica or excessive mouthing.	• **Manage as for 9.5-14.4 mcg/dL AND** • Consider gut decontamination if foreign bodies are seen on abdominal X-ray. • If single VBLL in this range, contact the local CLPPP (or, if no local program, the state CLPPB) for full case management services for children aged birth to 21 years or for questions about clinical management.[1] • Chelation is not recommended in this BLL range.

[1] www.cdph.ca.gov/programs/CLPPB

Evaluation and Management for VBLL 19.5-44.4 mcg/dL

Evaluation	Management
• **Evaluate as for 14.5-19.4 mcg/dL** • Consider abdominal X-ray to check for lead-based paint chips and other radiopaque foreign bodies.	• **Manage as for 14.5-19.4 mcg/dL[1] AND** • Consider referral to California Children's Services (CCS). Requires VBLL ≥ 20 mcg/dL.[3] • Consider referral for medical nutrition therapy.[4] • Chelation is not recommended in this BLL range.

[1] www.cdph.ca.gov/programs/CLPPB

Evaluation and Management for VBLL 44.5-69.4 mcg/dL - URGENT

Evaluation	Management
• **Evaluate as for 19.5-44.4 mcg/dL AND** • Obtain abdominal X-ray.	• **Manage as for 19.5-44.4 mcg/dL AND** • Consider chelation. • Refer to CCS. • **Consult with a physician experienced in managing chelation.** • Evaluate whether hospitalization is needed to reduce lead exposure and achieve compliance with treatment protocols. • If admitted, child must be discharged to a lead-safe environment. • Immediately notify local CLPPP or state CLPPB.[1]

[1] www.cdph.ca.gov/programs/CLPPB

Evaluation and Management for VBLL ≥ 69.5 mcg/dL – MEDICAL EMERGENCY

Evaluation	Management
• **Evaluate as for 44.5-69.4 mcg/dL AND** • Obtain abdominal X-ray. **CAUTION:** Depending on BLL, high index of suspicion, and/or clinical status, initiating management prior to receiving confirmatory VBLL result may be indicated.	• **Manage as for 44.5-69.4 mcg/dL AND** • **If BLL is confirmed**, hospitalize to stabilize, chelate, reduce lead exposure and monitor progress. • **Consult with a medical toxicologist or pediatric hematologist experienced in managing chelation.** • Perform gut decontamination, if indicated, **BEFORE** chelation. • Immediately notify local CLPPB or state CLPPB.[1] • Child must be discharged to a lead-safe environment.

[1] www.cdph.ca.gov/programs/CLPPB

References for 94-110 -Slide 156

Chelation Therapy

- Consult with a medical toxicologist or pediatric hematologist experienced in managing chelation.
- Depending on BLL and clinical status, initiating chelation prior to receiving confirmatory result may be indicated.
- Not usually indicated below 44.5 mcg/dL.[5,6]
- Perform gut decontamination, if indicated, **BEFORE** chelation.
- Possible chelating agents (may need to work with a compounding pharmacy):
  - Succimer (Chemet) (oral)
  - $CaNa_2EDTA$ per hospital protocol
  - $CaNa_2EDTA$ with dimercaprol (BAL) may be considered at levels ≥ 69.5 mcg/dL, if indicated

Chelation Therapy (Cont'd)

- **CAUTION**:
  - **Use only <u>CALCIUM</u> Na_2EDTA.**[7]
  - If using $CaNa_2EDTA$ with BAL, **assess for peanut allergy** (BAL is suspended in peanut oil).
- Very high BLLs have been associated with renal tubular dysfunction.
  - If using potentially nephrotoxic chelating agents (e.g., $CaNa_2EDTA$), **test renal function before and during treatment.**[8]
- Repeat treatment cycles may be needed due to blood lead rebound.

CDC Initial BLL Testing Recommendations for Newly Arrived Refugees

- Initial lead exposure screening with blood test:
- All refugee infants and children ≤ 16 years of age
- Refugee adolescents > 16 years of age if there is a high index of suspicion, or clinical signs/symptoms of lead exposure
- All pregnant and lactating women and girls

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CDC Refugee Follow-up BLL Testing Recommendations

- Retest 3-6 months after initial testing:
  - All refugee infants and children ≤ 6 years of age, regardless of initial screening result.
  - Refugee children and adolescents 7–16 years of age who had BLLs ≥ 3.5 mcg/dL.
  - For any child older than 7 years of age who has a risk factor (e.g., sibling with BLL ≥ 3.5 mcg/dL, environmental exposure risk factors) regardless of initial test result.
  - Pregnant or lactating adolescents (<18 years of age) who had BLLs ≥ 3.5 mcg/dL at initial screening.
  - California guidelines for all children up to age 21 mandate repeat BLL if initial BLL ≥ 3.5 mcg/dL.

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Further CDC Refugee Recommendations

- All newly arrived pregnant or breastfeeding women should be prescribed a prenatal or multivitamin with adequate iron and calcium
- Referral to a healthcare provider with expertise in high-risk lead exposure treatment and management may be indicated for elevated BLLs.

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

California Refugee Blood Lead Testing 2018-2022

- CLPPB matched refugee data from California Office of Refugee Health (ORH) from 2018 to 2022 with blood lead data from the Childhood Lead Poisoning Prevention Branch.
- CLPPB was able to match 11,215 children of the 12,840 children in the ORH file based on a combination for first name, last name, and birthdate.
- This is preliminary data and subject to change.

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California Refugee Blood Lead Testing 2018 – 2022 by Country of Origin

Country	Number of children	Percentage
Afghanistan	8033	71.63%
Ukraine	1530	13.64%
Syrian	188	1.68%
Haiti	159	1.42%
Republic of Moldova	110	0.98%
El Salvador	90	0.80%
Guatemala	87	0.78%
Armenia	86	0.77%
Russian Federation	76	0.68%
China	69	0.62%
Other countries	787	7.02%

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California Refugee Blood Lead Testing 2018 – 2022 by Age Groups

Age Categorizes	Number of children	Percentage
Less than 6 months	134	1.19%
6 to <1 year	282	2.51%
1 to <3 years	1565	13.95%
3 to <7	3369	30.04%
7 to 16 year olds	5865	52.30%

CDPH California Department of PublicHealth

California Refugee Blood Lead Testing 2018 - 2022

Gender	Number of children	Percentage
Female	5489	48.94%
Male	5723	51.03%
Other	3	0.03%

California Refugee Blood Lead Testing 2018 – 2022

BLL level	Number of children	Percentage
Less than 3.5 mcg/dL	6845	61.03%
3.5 mcg/dL to 9.4 mcg/dL	3858	34.40%
9.5 mcg/dL to 14.4mcg/dL	347	3.09%
14.5 mcg/dL to 19.4 mcg/dL	82	0.73%
19.5 mcg/dL to 44.4 mcg/dL	65	0.58%
> 44.5 mcg/dL	18	0.16%

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California Refugee Blood Lead Testing by Age Group and Country of Origin

Country of Origin	0-6 months (%)	6 months – under 1 year (%)	1 year to under 3 years (%)	3 years to under 7 years (%)	7 years to 16 years (%)
Afghanistan	95 (1.2%)	235 (2.9%)	1191 (14.8%)	2548 (31.7%)	3964 (49.3%)
Ukraine	10 (0.7%)	18 (1.2%)	180 (11.8%)	405 (26.5%)	917 (59.9%)
Syrian Arab Republic	0 (0%)	0 (0%)	3 (1.6%)	22 (11.7%)	163 (86.7%)
Other Countries	23 (1.6%)	25 (1.8%)	180 (12.8%)	378 (27%)	796 (56.8%)

CDPH California Department of PublicHealth

California Refugee Blood Lead Testing BLL by Age Group

BLL level	Less than 6 mo (%)	6 mo to <1 year (%)	1 to <3 years (%)	3 to <7 years (%)	7 to 16 years (%)
Less than 3.5 mcg/dL	101 (75%)	168 (60%)	840 (54%)	1856 (55%)	3800 (66%)
3.5 to 9.4 mcg/dL	22 (16%)	71 (25%)	571 (36%)	1359 (40%)	1835 (31%)
9.5 to 14.4mcg/dL	3 (2%)	24 (9%)	104 (7%)	108 (3%)	108 (2%)
14.5 to 19.4 mcg/dL	3 (2%)	9 (3%)	22 (1%)	27 (1%)	21 (0%)
19.5 to 44.4 mcg/dL	3 (2%)	7 (2%)	22 (1%)	13 (0%)	20 (0%)
> 44.5 mcg/dL	2 (2%)	3 (1%)	6 (0%)	6 (0%)	1 (0%)

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California Refugee Blood Lead Testing – BLL by Gender

BLL level	Male	Female
Less than 3.5 mcg/dL	3390 (50%)	3450 (50%)
3.5 mcg/dL to 9.4 mcg/dL	2071 (54%)	1785 (46%)
9.5 mcg/dL to 14.4mcg/dL	188 (54%)	161 (46%)
14.5 mcg/dL to 19.4 mcg/dL	39 (48%)	43 (52%)
19.5 mcg/dL to 44.4 mcg/dL	31 (48%)	34 (52%)
> 44.5 mcg/dL	6 (33%)	12 (67%)

CDPH California Department of PublicHealth

California Blood Lead Testing – BLL by Country of Origin

BLL Level	Afghanistan	Ukraine	Syrian Arab Republic	Other
Less than 3.5 mcg/dL	3802 (47%)	1503 (98%)	185 (98%)	1355 (93%)
3.5 to 9.4 mcg/dL	3753 (47%)	11 (1%)	3 (2%)	91 (6%)
9.5 to 14.4 mcg/dL	333 (4%)	2 (0%)	0 (0%)	12 (6%)
14.5 to 19.4 mcg/dL	81 (1%)	0 (0%)	0 (0%)	1 (0.9%)
19.5 to 44.4 mcg/dL	59 (1%)	1 (0%)	0 (0%)	5 (0.4%)
> 44.5 mcg/dL	5 (0%)	13 (1%)	0 (0%)	0 (0.00%)
Total by country	8033	1530	188	1464

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Nutrition and Lead Absorption

Nutritional Changes Can Reduce Lead Absorption

- Ingested lead is much more bioavailable when fasting than after a meal
- Lead is absorbed via the same pathways as dietary iron and calcium
- Children absorb significantly more lead than adults via the GI tract[1,2]
- Good nutrition, especially iron, vitamin C, and calcium, can help decrease lead absorption
- Refer low-income families to WIC, when appropriate

[1] Zeigler EE, et al, Absorption and retention of lead by infants. Ped Res,12:29-34, 1978

[2] Alexander FW, The uptake of lead by children in differing environments, Env Health Perspect, May 1974, p 155-159

Malnourished Children

- Malnourished children (such as newly arrived refugees) are at greater risk for lead poisoning
  - Micronutrient deficiencies can increase absorption of lead
    - Especially if dietary iron or calcium deficiency
    - Zinc deficiency may also increase a child's risk[1]
- CDC recommends providing daily pediatric multivitamins with iron to all refugee children aged 6 months to 6 years of age and multivitamins with iron and calcium for refugee women and girls who are pregnant or breastfeeding[2]

[1] Bhutta ZA, Micronutrient needs of malnourished children, Current Opinion in Clinical Nutrition and Metabolic Care 2008, 11:309–314

[2] CDC, Screening for Lead during the Domestic Medical Examination for Newly Arrived Refugees

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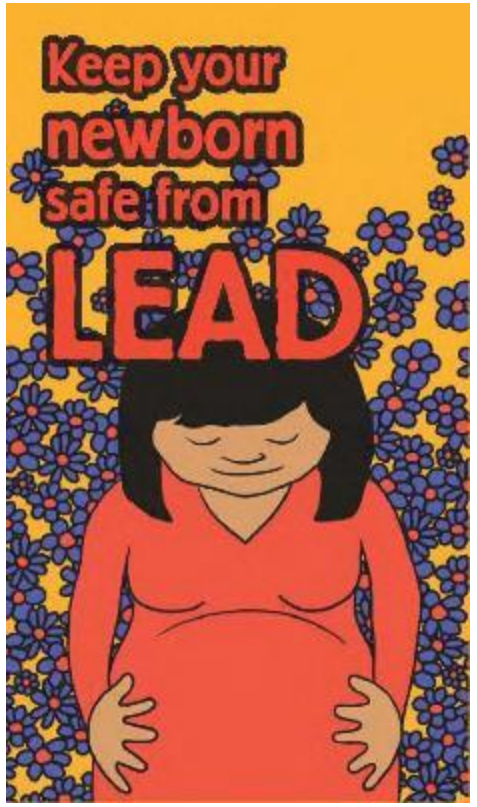
Lead in Pregnancy and Breastfeeding

Lead During Pregnancy

- Lead crosses the placenta.
- If maternal VBLL is ≥ 5 mcg/dL
  - Mother will require more frequent testing.
  - Infant's cord blood should be tested at birth.
  - Infant BLL at birth is proportional to and close to maternal BLL.
  - Provide 2000 mg calcium per day in divided doses during pregnancy and lactation to reduce bone resorption.[1]
  - Maternal BLL will decrease in the second trimester due to physiologic increase in blood volume – continue to test during pregnancy, at delivery, and at least one month post-partum



[1] American College of Obstetrics and Gynecology, Committee Opinion No. 533, Aug 2012,Committee on Obstetric Practice, Lead Screening During Pregnancy and Lactation

CDC Guidance on Breastfeeding When Mother Has an Elevated BLL

- Breast milk lead is approximately 3% of maternal VBLL but can be as high as 7.5%.[1]
- Breast milk lead concentration increases in a non-linear fashion as the maternal blood lead level increases above 40 mcg/dL.
- For breastfed infants whose BLLs are rising or failing to decline by 5 mcg/dL or more, environmental and other sources of lead should be evaluated.[1]

[1] Ettinger A, Guidelines for the Identification and Management of Lead Exposure in Pregnant and Lactating Women, CDC, 2010:84-85,99-101

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CDC Recommendations on Lead Levels with Regard to Breastfeeding (Cont'd)

- If no external source of lead exposure is identified, and maternal BLLs are ≥ 20 mcg/dL and infant BLLs are ≥ 5 mcg/dL
  - Breast milk may be the source.
  - Consider temporarily pumping and discarding the breast milk until maternal BLLs are lower.
- Mothers with BLLS ≥ 40 mcg/dL should pump and discard their breast milk until maternal BLLs are lower.
- CDC guidance on testing and follow-up of pregnant and breastfeeding women with BLLs ≥ 5 mcg/dL and testing and follow-up of their infants can be found at: CDC, Lead and Pregnancy.

CDC, Breastfeeding and Special Circumstances, Environmental Exposures, Lead

Services Provided by California Childhood Lead Poisoning Prevention Programs

State Case Definitions

- Children with blood lead levels ≥ 3.5 mcg/dL to 9.4 mcg/dL are considered basic state cases.
- Full State Cases
  - Children with a single venous BLL ≥ 14.5 mcg/dL OR
  - Children with two BLLs ≥ 9.5 mcg/dL; the second BLL must be venous
  - Receive PHN home visits, case management and Environmental Professional services
- All follow-up testing must be venous for children meeting basic or full state case definition.

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Public Health Services For Full State Cases

- Public Health Nurse (PHN) Case Management
  - PHN visits
  - Outreach and education
  - Nutrition assessment and neurodevelopmental screening
  - Coordination with health care providers and referrals to public health services
  - Monitoring and follow-up
- Assessment by an Environmental Professional
  - Environmental assessment of home
  - Enforcement of lead remediation and abatement

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Take-Home Messages

Prevention is the Goal

- Prevention is the best approach to lead exposure
- Low levels of lead can cause developmental delay and organ damage
- Anticipatory guidance is mandated for all children from age 6 months to 6 years at every well child check
- Young children in publicly funded programs and those who live in or spend time in older buildings and housing are most at risk and are mandated to be tested
- Refugees and recent immigrants are also at risk and should be tested

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Prevention is the Goal (cont'd)

- Low levels of lead that don't cause overt symptoms can have adverse effects on neurocognitive and neurobehavioral development.
- Pediatric exposure can have long term consequences.
- Consider lead in your differential diagnosis for children with cognitive or behavioral deficits, anemia, and nonspecific constitutional symptoms.

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Most Common Exposure Sources

- Most common exposure is from lead-contaminated paint, dust, or soil
- Other sources need to be considered
  - Occupational take-home
  - Lead containing:
    - Foods and spices
    - Consumer products
    - Remedies and cosmetics
  - Hobbies

Take-Home Messages

- **Testing at-risk children is the best method of early detection**
- **Lead exposure is cumulative**
- **Pediatric exposure can have long term consequences**

LA Care Post-Test

forms.office.com/g/jmqmzw9yQh

Lead Free Homes LA

Countywide Lead Paint Remediation Program

Janet Scully, MPH
Program Manager

November 8, 2023

Countywide Lead Paint Remediation Program

LA County will receive approximately $134 million over the course of 7 years to implement a 10-year Countywide Lead Paint Remediation Program

Funds are used to **remediate interior and exterior lead-paint hazards in county residences**

Focused on most **vulnerable populations** – families most at risk for lead poisoning **are prioritized for remediation services**

Prioritize referrals from CLPPP to remove lead-based paint hazards in **homes of lead-burdened children** throughout the County

Prioritization Areas & Groups

TARGETED REGIONS
Large pre-1951 housing stock
High prevalence of low-income families
Significant population of young children (under age 6)

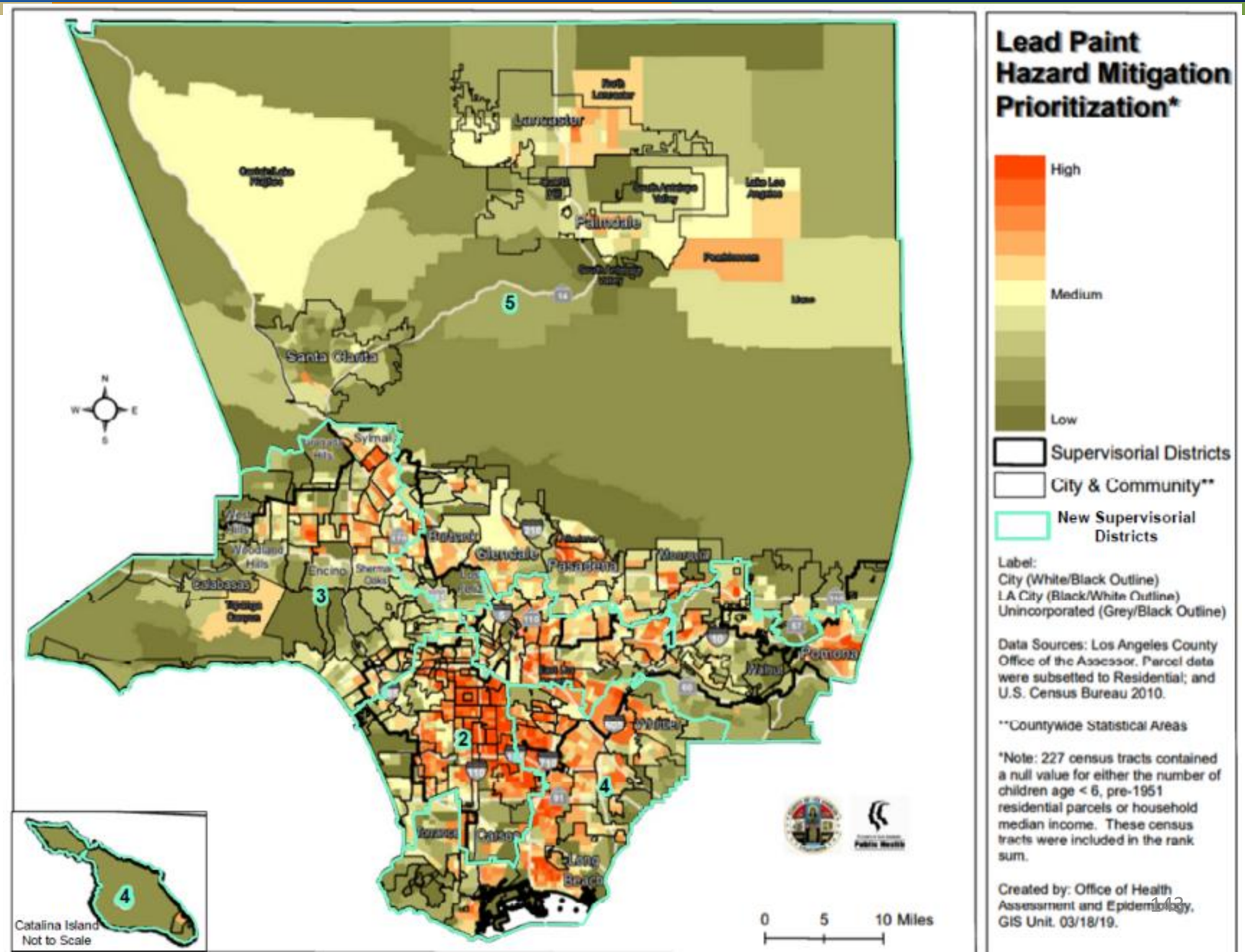
PRIORITY GROUPS
Children with elevated blood lead levels
Children under age 6
Pregnant women
Environmentally disadvantaged communities







Target Area Map



Recruitment Strategy

Designed around consistent spending to **ensure funds are available to reach all identified high-risk communities** while minimizing time residents wait between enrollment and remediation. Budget estimates 400 remediated homes a year.

Example recruitment phase timeline

Month 1 | Month 2 | Month 3 | End of Phase

Months 1-3 (start until final month)

Active Field Recruitment

- Program materials sent to identified homes in the active service area (program brochure, Supervisor letter, door hangers, post cards) – **most successful**
- Enrollment agents are door knocking, making phone calls, and attending community events

DPH Media Campaign Support

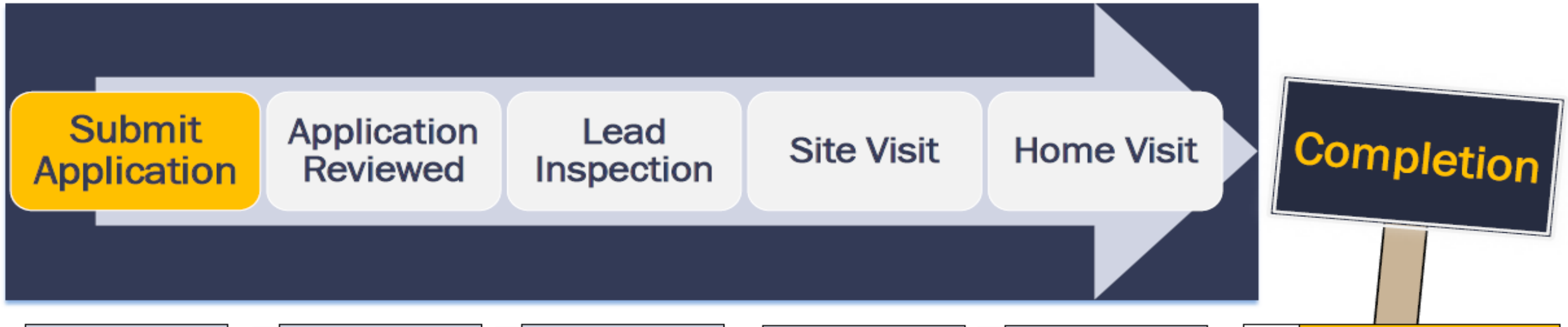
- Digital (social media, digital ads)
- Direct-to-resident texting
- Place-based ads (convenience stores, doctor's offices, childcare centers, gas stations, community centers, houses of worship)
- Outdoor (bus tails, bus shelters, billboards)

Final Month

Wrap Up and Preparation

- Active field work scaled back to focus on any backlog of applications and push enrollment through for active community
- Strategizing for next community

Lead Free Homes LA Program



SUBMIT APPLICATION

Application Info mailed to each residential address. Families may:

- Apply online.
- Call the Outreach and Enrollment Agent for assistance.
- Come into an office for live assistance.

APPLICATION REVIEWED

Outreach and Enrollment Agent processes application.

- Verifies that application is complete.
- Contacts family.
- Determines eligibility.
- Welcomes eligible families to the Lead Free Homes LA Program!

LEAD INSPECTION

Contractor inspects for lead-based paint hazards and will:

- Schedule for a mutually convenient time.
- Call residents in their language.
- Inspect interior and exterior of home. IF LEAD IS FOUND ONLY: Family's home continues with program.

SITE VISIT

inspector visits property.

- Sees location of lead-based paint hazards.
- Scope of Work is created.

HOME VISIT

Family and program staff meet in the home.

- Family reviews lead remediation plan with the Construction Management Unit's Manager.
- Family identifies their relocation needs with Relocation Consultant.

COMPLETION

No-cost construction activities are finished,

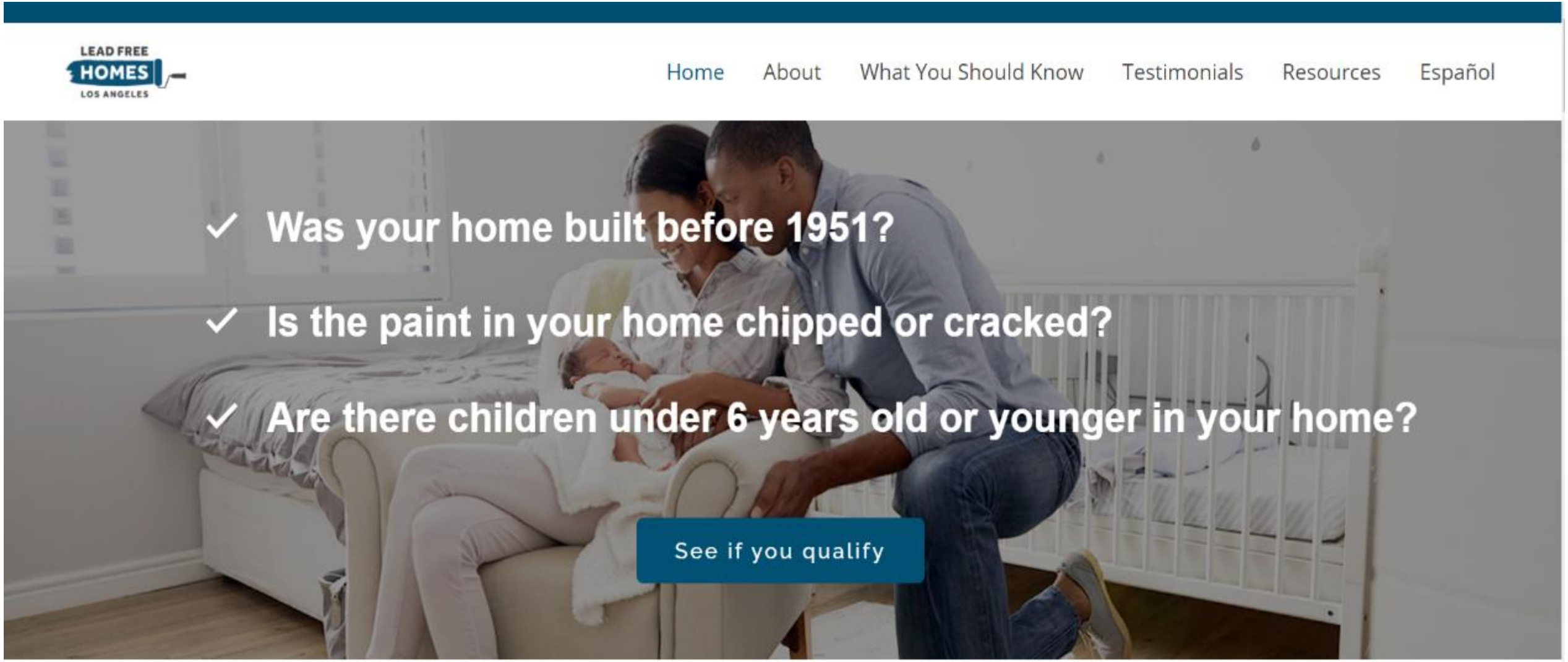
County ensures that property is cleared of lead-based paint hazards.

Family returns to their home knowing the health of their children is protected.

Lead Free Homes LA launches and operates in 5 areas of the County, each with its Outreach and Enrollment Agent.

Enrollment is in a phased approach. The program is available in one community and then moves to another. Residents will be able to apply after receiving a letter from their trusted officials.

LeadFreeHomesLA.com | HogaresLibreDePlomoLA.com



Educational Resources

- **Los Angeles County Childhood Lead Poisoning Prevention Program** (CLPPP) offers resources for parents/caregivers, contractors, and property owners on how to prevent, detect, and treat lead exposure and poisoning.
  - File a Complaint (with Environmental Health)
  - Make Your Home Lead Safe for Children
  - Handle Lead Paint with Care
  - The Lead-Safe Certified Guide to Renovate Right

- **EPA**: Find a lead-safe contractor and more information on how to safely clean, build, and renovate

Thank you!

Janet Scully

(323)509-6332

jscully@ph.lacounty.gov

County of Los Angeles Public Health

LEAD FREE HOMES LOS ANGELES

HOGARES LIBRES DE PLOMO LOS ANGELES

“A Full Picture Of Nursing Case Management Efforts”

Los Angeles County –Department of Public Health
Maternal, Child & Adolescent Health Programs
Childhood Lead Poisoning Prevention Program

Phyu Lin, PHN

- **E-Mail:**

plin2@ph.lacounty.gov

- **Case Management Unit**
  # 323 659-6559
- **CLPPP Hotline 1 800 LA-4-LEAD**

What Does the PHN Team Do?

Manage	Manage Case Management Goals
Identify	Identify the sources of lead exposure
Interrupt	Interrupt the pathway of the lead exposure
Ensure	Ensure a reduction in elevated blood lead levels
Reduce	Reduce the consequences of lead exposure
Increase	Increase public awareness of lead exposure and lead hazards

Disease Investigation

Conduct	Conduct a home visit
Interview	Interview family to gather information
Assess	Assess patient's health status and needs
Identify	Identify household members at risk and connect them to health services and resources

Health Teaching
Referral and Follow-up

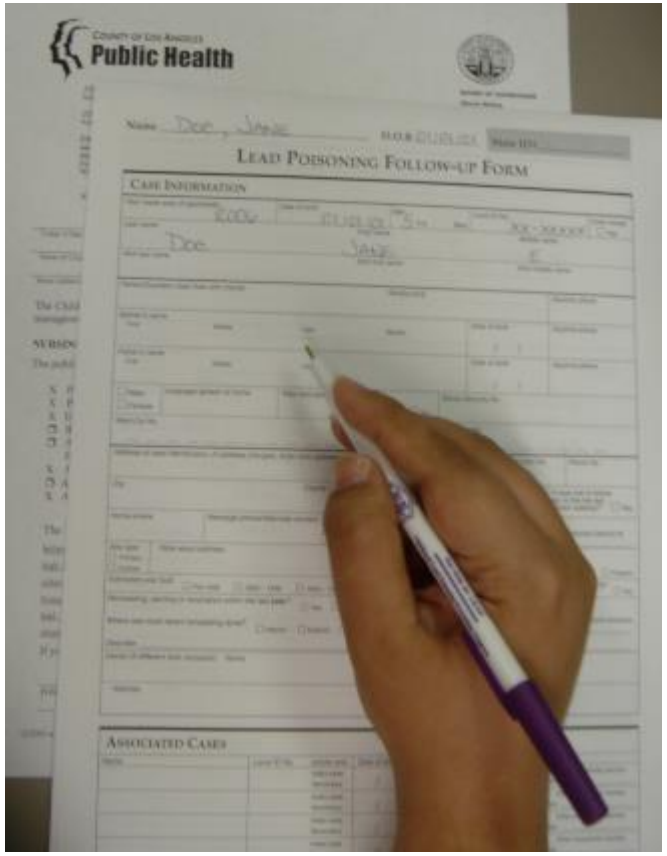
Educate the family on facts, ideas and skills that change knowledge, behaviors & cultural practices

Assist family to identify and access necessary services and resources

Surveillance

- Provide ongoing and systematic collection of health data through interviews and assessment

- Document health data on the lead poisoning follow-up form and in the medical record



Outreach

Review	Inform	Provide
Review blood lead screening requirements, retesting schedules, and medical guidelines with the primary care provider (PCP)	Inform the PCP of the available trainings and lead awareness materials	Provide technical support as needed

ENVIRONMENTAL HEALTH

Registered Environmental Health Specialists

Received specialized training state certification with CLPPB to perform EIs

PURPOSE OF **EI**
(Environmental Investigation)

Identify	Determine	Prevent
Identify environmental lead hazards at a property	Determine possible source of patient's lead-poisoning	Prevent further exposure to lead hazards

ENVIRONMENTAL TESTING

- Paint interior/exterior
- Dust interior/exterior
- Soil i.e. Bare soil
- Water
- Non-Housing items
  - Toys, Candies

Summary

- Los Angeles County Childhood Lead Poisoning Prevention Program(CLPPP) provides comprehensive case management services to identify, provide health education, disease management, lead inspections and community referrals to pregnant women, children and adults between the ages of birth to 21 years of age. Our team members collaborate with families and their PCP to provide lead awareness, promote healthy behaviors and promulgate CLPPB recommended guidance lead poisoning management

Questions?

Thank you!

California Department of Public Health
Childhood Lead Poisoning Prevention Branch

510-620-5600

https://www.cdph.ca.gov/programs/clppb

Please send questions and requests to:

CLPPB_Provider_Outreach@cdph.ca.gov

Resources

California CLPP Programs

- An index of CLPP programs appears at the following link. The starred (*) counties do not have formal childhood lead poisoning prevention programs under contract with the state.

https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/CLPPB/Pages/CLPPPIndex.aspx

- If not in a contracted county, contact the state Childhood Lead Poisoning Prevention Branch: ask for the Care Management Section

https://www.cdph.ca.gov/programs/clppb

Provider Guidelines

- California Management Guidelines on Childhood Lead Poisoning for Health Care Providers
- Standard of Care Guidelines on Childhood Lead Poisoning for California Health Care Providers
- Blood Lead Testing Guidance

To Order Patient or Provider Materials

- **Patient materials:**

https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/CLPPB/Pages/edmatls.aspx

- **Provider materials:**

https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/CLPPB/Pages/prov.aspx

- **To order any of these materials, contact the Branch at:**

CLPPB_Provider_Materials@cdph.ca.gov

CDPH California Department of PublicHealth

CDC Guidance on Capillary Blood Testing

- CDC guidance on capillary blood lead testing
- The CDC instruction poster, Steps for Collecting Finger Stick Capillary Blood Using a Microtainer®
- CDC Capillary Lead Testing Video

State and County Resources

- California Lead Poisoning Prevention Branch

https://www.cdph.ca.gov/programs/clppb

- County Childhood Lead Poisoning Prevention Program

https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/CLPPB/Pages/CLPPPIndex.aspx

- Lead Related Construction Program

https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/CLPPB/Pages/LRC.aspx

- Occupational Lead Poisoning Prevention Program

https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/OHB/OLPPP/Pages/OLPPP.aspx

State and County Resources cont'd

- Medi-Cal – http://www.dhcs.ca.gov/services/medi-cal/Pages/default.aspx
- California Children's Services – CCS http://www.dhcs.ca.gov/services/ccs/pages/default.aspx
- Head Start - http://www.caheadstart.org
- CHDP – Child Health and Disability Prevention Program http://www.dhcs.ca.gov/services/chdp/Pages/default.aspx
- WIC - https://www.cdph.ca.gov/Programs/CFH/DWICSN/Pages/Program-Landing1.aspx

Federal Resources

- CDC - http://www.cdc.gov/nceh/**lead**/
- EPA - http://www.epa.gov/**lead**/
- EPA - Lead in drinking water

  EPA Guidance on lead in drinking water
- US Consumer Product Safety Commission www.cpsc.gov
- US Food and Drug Administration – http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/ChemicalContaminantsMetalsNaturalToxinsPesticides/ucm077904.htm

CDPH California Department of PublicHealth

State Food and Drug Resources

- California Food and Drug Branch – Lead in Candy

  https://www.cdph.ca.gov/Programs/CEH/DFDCS/Pages/FDBPrograms/FoodSafetyProgram/LeadInCandy.aspx

- California Safe Cosmetics Program
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