ACKNOWLEDGMENTS

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**HOUSEKEEPING**

- For educational and quality improvement purposes, this teleECHO session will be recorded
  - By participating in this session, you are consenting to be recorded – we appreciate and value your participation
- To protect patient privacy, please do not provide any protected health information (PHI)
- Please mute your microphone when not speaking
- Please enable your video if possible
- Chat with Loretta I. Hoepfner in Chatbox if you need technical assistance
AGENDA

• Welcome – Loretta I. Hoepfner
• Lecture Presentation – Mike Ichniowski, MD, FAAP
• QI Data Review – Troy Jacobs, MD, FAAP
• Case Presentation – Paul Rogers, MD, FAAP
• Case Discussion – All
• Follow Up and Next Steps – Loretta I. Hoepfner
TODAY’S LECTURE

Lead Testing and Risk Assessment

Michael Ichniowski, MD, FAAP

December 7, 2022
Learning Objectives

1. Identify vulnerable populations of children eligible for lead risk screening and testing.
2. Understand current CDC, AAP and MDH recommendations regarding when and how to test children’s blood lead levels.
3. Cite barriers/strategies to improve testing in office practice.
4. Review findings of lead in drinking water in Flint, Michigan and Maryland
LEAD HAZARD SCREENING & TESTING

SCREENING – families are surveyed for risk factors known to be associated with elevated BLLs (also known as “risk assessment”)

Per AAP Guidelines: screen at the following well-child visits: 6 months, 9 months, 12 months, 18 months, 24 months, and at 3, 4, 5 and 6 years of age (https://www.aap.org/en/patient-care/lead-exposure/detection-of-lead-poisoning/)

TESTING – performance of a finger-stick or a venous blood lead level to determine whether a child has been exposed.

Maryland testing required for all children at 12 and 24 months and for children at-risk (https://health.maryland.gov/phpa/OEHFP/EH/Pages/LeadTesting.aspx)

• Children ≤16 years who are recent immigrants, refugees, or adoptees should be tested at the earliest opportunity (https://www.cdc.gov/immigrantrefugeehealth/guidelines/lead-guidelines.html)
MARYLAND LEAD RISK ASSESSMENT SCREENING QUESTIONS

Does the child live in or regularly visit a property built before 1978 with: chipping/peeling/deteriorating paint; recent or ongoing renovation or remodeling; lead water service lines or lead-soldered copper pipes?

Has the child ever lived outside the US or recently arrived from a foreign country? This includes international adoptees, immigrants and foreign refugees.

Does the child have a sibling/housemate/playmate with an elevated blood lead level (BLL)? Has the child's mother been exposed to lead during pregnancy or had an elevated BLL as a child?
MARYLAND LEAD RISK ASSESSMENT SCREENING QUESTIONS

If born before 1/1/2015, does the child live in an "at risk" zip code, as determined by the 2004 Maryland Lead Poisoning Targeting Plan? (If born 1/1/2015 or later, testing is required at ages 1 and 2 years old).

Does the child frequently put non-food items in their mouth? Ex.: paint chips, toys (including those recalled due to lead content), jewelry (especially low-cost costume jewelry) or eat non-food items (pica)?

Consider developmentally disabled children who may have pica or oral mouthing habits. Children with iron deficiency are also at risk for increased absorption when lead is ingested.
MARYLAND LEAD RISK ASSESSMENT SCREENING QUESTIONS

Does the child have contact with an adult whose occupation or hobby involves exposure to lead? Examples: home renovator/remodeler; industrial painter; auto repair; law enforcement/other shooting range participants; fishing; pottery glazing; stained glass; fine art painting

Does the child live near a lead-related industry or a site/road where soil or dust may be lead-contaminated? Examples: lead smelter; battery recycling plant; hazardous waste site; landfill; incinerator; roads with heavy auto/truck traffic; airport serving smaller piston-engine planes

Are products from other countries used in the home, including: health remedies; spices (turmeric); candies (tamarind); cosmetics (kohl, surma)? Are foods stored in or served from glazed pottery; pewter; lead-soldered cans; leaded crystal?
AAP RECOMMENDATIONS

- Risk assessment (screening) at well-child visits thru 6 years of age
- BLL if risk assessment is positive
- Universal testing of Medicaid recipients

COEH. Pediatrics 2016; Volume 1 38, number 1, July 2016: e20161493
**Blood Lead Testing**

Capillary testing with LeadCare II (Magellan Diagnostics)

- CLIA-waived test (CLIA certificate $150 for 2 years)
- Fingerstick of clean skin prepped with lead-free alcohol prep & gauze
- 50 uL specimen in anticoagulated capillary tube
- Sensitivity limit 3.3ug/dL; reporting range 3.3-65ug/dL
- Result ≥3.5ug/dL requires venous test for confirmation
- Use of outdated reagents can cause testing errors
**Blood Lead Testing**

Venous testing—sent to hospital or medical laboratory

- Testing by Atomic Absorption Spectroscopy (AAS) or Inductively Coupled Plasma/Mass Spectroscopy (ICP/MS)
- Venipuncture site prepped with lead-free alcohol prep & gauze
- 3mL in tan-top Potassium EDTA anticoagulated tube (0.5 mL minimum)
- Sensitivity to 1 ug/dL; reporting range 1-100 ug/dL
MARYLAND LEAD TESTING REQUIREMENTS

Per Regulations enacted 3/28/2016, blood lead test is required for:

- All children born on or after 1/1/2015 and all children enrolled in Medicaid at 12 & 24 months of age
- Any child >24 months and <6 years of age not previously tested or without a documented blood lead test
- Any child whose parent/guardian request a test, regardless of age
- Any child with a positive response on lead screening questionnaire (at well visits 6 months-6 years)
- Venous test required if capillary test reveals elevated BLL

House Bill 1110 passed in 2022 lowered the BLL for case management assistance and notification to ≥3.5μg/dL, effective 10/28/2022
**MD Documentation & Reporting Requirements**

**Documentation:** Results and dates of 12 & 24 month blood lead tests at first entry to a MD public Pre-K, KG or 1st Grade, or most recent test result at age <6yrs if not tested at 12 & 24 months, signed and dated by primary care provider/designee (Most MD private schools have the same requirement)

**Reporting** of blood lead results must include:

- Blood lead level in ug/dL and type of specimen (venous or capillary)
- Child's first & last name and middle initial; DOB, country of birth, sex, race, ethnicity and Medical Assistance#, if enrolled
- Complete home address, phone# and parent's/guardian's name
- Name, address, phone# and NPI of provider's office or facility where blood sample was obtained
BARRIERS

• Parental compliance with blood testing
• Availability/affordability of in-office testing
• Time pressures/constraints
• Uncertainty about lead risk in community
• Uncertainty about testing recommendations
• Insurance reimbursement for testing/supplies/staff time
• COVID catch-up
STRATEGIES FOR IMPROVING TESTING AND FOLLOW-UP

- Audit office performance (AAP Lead Testing ECHO)
- Change office flow patterns to facilitate testing
- Offer point-of-service testing
- Electronic tickler file for follow-up testing
- Improve provision of parental education and local resources
THE FLINT WATER CRISIS

• April 2014-City water supply changed from Lake Huron via Detroit to Flint River (which runs through the city) to reduce costs in a financially struggling city

• Changes in water color, odor and taste and health issues noted after the switch

• Increased lead levels identified in multiple tap water samples throughout Flint

• Dr. Mona Hanna-Attisha, a Flint pediatrician, noted increase in patients with elevated BLL; performed analysis of BLL in children in Flint before and after the switch in water source (results released Sept 2015)
ELEVATED BLOOD LEAD LEVELS IN FLINT

Study results:

• In all of Flint: EBLL increased from 2.4% to 4.9% after change in water source (P<0.5)

• In Flint with high water lead levels: EBLL increased from 4.0% to 10.6% (P<0.5)

• Outside Flint (no change in water source): increased from 0.7% to 1.2% (P>0.5)
WHAT CAUSED THE LEAD CRISIS IN FLINT

• Flint River water was more corrosive: higher chloride level and no corrosion inhibitors, as are used in Lake Huron-Detroit water supply

• Flint's water distribution system contained a high percentage of lead service lines and in-home plumbing; the corrosive water led to increased leaching of lead from these pipes

• Health inequity: areas in Flint with older housing (socioeconomically disadvantaged) had higher percentage of elevated lead levels in water supply and more children with EBLL
In 2019 Maryland adopted the Safe Water Drinking Act to reduce Maryland school children’s exposure to lead in drinking water.

The law provides funding to help schools meet the lead level of no more than 5 parts per billion (ppb) in drinking water outlets.

The law requires testing in public and non-public schools on a three-year cycle.

Out of 59 schools surveyed in 2020-2021, 13.9% had lead levels exceeding 5 ppb.

ADDITIONAL RESOURCES


• Chandran V. Lead poisoning basics and new developments. Pediatrics in Review 2010;31(10); 399-406.
ADDITIONAL RESOURCES (CONTINUED)


• Lidsky T. Adverse effects of childhood lead poisoning: The clinical neuropsychological perspective. 2006: Environmental Research 100; 284-293.

QUESTIONS?
QI Data Review

Troy A. Jacobs, MD, MPH, FAAP
PDSA Worksheet

Name of Practice:

Date:

PDSA for Data Cycle:

Desired Goal

PLAN (statement of what you are planning to do and test adding a measurement goal)

We plan to:
In hopes that this produces:
How we will execute/ steps to follow
1
2
3

DO (after planning, you will implement and monitor, what happens during implementation?)

What did you observe?
Did it go as you planned? Explain:

STUDY (did your plan work? Did you meet your measurement goal?)

What did you learn from this intervention?
Did you achieve what you desired?

ACT (evaluation and next steps)

What did you learn/conclude from this cycle?
Will you adopt/adapt/abandon and why?
**QI OPPORTUNITIES—BREAKING DOWN THE BARRIERS**

**QI Team**
- Identify specific barriers at your practice
- Team Meeting
  - Workflow diagram
  - Review barriers and list ones that are relevant
  - Prioritize by voting
  - Brainstorm ways to improve

**Barriers**
- Compliance with blood testing
- Availability of in-office testing
- Time pressures/constraints
- Uncertainty about patients lead risk
- Uncertainty about testing recommendations
- Insurance reimbursement for testing
- COVID catch-up
Referral to Academic programming

- **All Groups**
  - Cycle 1 (N = 3)
  - Cycle: 2 (N = 3)
  - Cycle 1 (N = 1)
  - Cycle: 2 (N = 1)
  - Cycle 1 (N = 2)
  - Cycle: 2 (N = 2)
  - Cycle 1 (N = 0)
  - Cycle: 2 (N = 0)
# Data Collection

<table>
<thead>
<tr>
<th>Data Cycle #</th>
<th>Month of Visit (pull charts from time period listed below)</th>
<th>Date Entry in QIDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (baseline)</td>
<td>August 1-31, 2022</td>
<td>September 28, 2022</td>
</tr>
<tr>
<td>2</td>
<td>September 1-30, 2022</td>
<td>October 14, 2022</td>
</tr>
<tr>
<td>3</td>
<td>October 1-31, 2022</td>
<td>November 11, 2022</td>
</tr>
<tr>
<td>4</td>
<td>November 1-30, 2022</td>
<td>December 9, 2022</td>
</tr>
<tr>
<td>5</td>
<td>December 1-31, 2022</td>
<td>January 13, 2023</td>
</tr>
<tr>
<td>6</td>
<td>January 1-31, 2023</td>
<td>February 10, 2023</td>
</tr>
<tr>
<td>7</td>
<td>February 1-28, 2023</td>
<td>March 10, 2023</td>
</tr>
</tbody>
</table>
QUESTIONS?
CASE PRESENTATION

Paul Rogers, MD, FAAP
CASE PRESENTATION: BJ DOB 2004

This 18-year-old female with a history of childhood lead poisoning is in your office for an annual physical exam. From her birth to the age of sixteen months, she lived in an apartment that tested positive for lead-based paint hazards. The property in Baltimore City was built in 1913 and originally was a schoolhouse converted to 32 apartments in 1979 for low-income families.
Case Presentation

Past Medical History: BJ’s birth, neonatal course, developmental language, and gross motor milestones were all WNL. She graduated from high school with a diploma and had a GPA of 0.89 and was 113 in a class of 117. She had disruptive behavior in school starting in second grade and was suspended in third grade for getting into fights in the cafeteria. While she attended high school, she occasionally used marijuana but denied alcohol use or illicit drug use. While in her junior year of high school she worked part-time at McDonald’s but was fired after two weeks for fighting with a fellow employee. The family history is negative for neurodevelopmental disabilities. BJ has been in good health and currently takes no prescribed medication. She denies traumatic brain injury, seizures, and meningitis. There are no abnormalities on physical and neurological exam.
**Case Presentation**

**BJ’s Lead Testing History:**

<table>
<thead>
<tr>
<th>EBL (µg/dL)</th>
<th>EBL (ppb)</th>
<th>Age</th>
<th>Date</th>
<th>Address</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.0</td>
<td>70</td>
<td>13 mon.</td>
<td>10/11/01</td>
<td>2000 East North Avenue Baltimore</td>
<td>Venous</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HgB 12.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ferritin 65 ng/ml (7-140 ng/ml)</td>
</tr>
<tr>
<td>3.0</td>
<td>30</td>
<td>35 mon.</td>
<td>8/28/03</td>
<td>Lead free property</td>
<td>Venous</td>
</tr>
</tbody>
</table>

**Neuropsychological Test Results:** She scored in the Borderline range on the WAIS-IV with a Full-Scale IQ score of 69. Academically, she scored for spelling at the fifth-grade level and for reading at the fifth-grade level. The testing showed areas of impairment that include memory, attention/concentration, and executive functioning.

**Vocational Assessment:** BJ had a vocational assessment that reported that she can be classified as a Cognitive Disabled female and that she will experience significant loss of earning capacity.
1. In additional to the usual labs, you would also order:
   a. Venous blood lead level
   b. A Ferritin level
   c. Urine tox screen
   d. Pregnancy test

2. You would provide/refer for:
   a. Counseling for anger management
   b. Nutrition counseling
   c. Substance abuse counseling
   d. Pregnancy prevention
3. You refer her to:
   a. A life coach
   b. DORS program
   c. A lawyer
   d. Vocational counseling

4. As an adult with a history of childhood lead poisoning, BJ is at substantial risk for:
   a. Premature death from cardiovascular disease
   b. Adverse pregnancy outcome
   c. Early onset dementia
   d. Legal difficulties
CASE PRESENTATION references

- **Bellinger D.** Childhood lead exposure and adult outcomes. JAMA March 29, 2017;317,(2); 1219-1220.
- **Lanphear B.** Low-level environmental lead exposure and children’s intellectual function: an international pooled analysis. Environmental Health Perspective 2005; 113, (7); 894-899.
• Lanphear B. Low-level environmental lead exposure and children’s intellectual function: an international pooled analysis. Environmental Health Perspective 2005; 113, (7); 894-899.

• McFarlane A. Prospective associations between child-hood low level lead exposure and adult mental problems. Neurotoxicology vol 39, Dec 2013, pg11-17.


• Olympio KP. Surface dental enamel lead levels and antisocial behavior in Brazilian adolescents Neurotoxicology Teratol. 2010; Mar-Apr; 32(2): 273-279

• Reuben A. Association of childhood lead exposure with adult traits and lifelong mental health. JAMA Psychiatry. 2019; 75(4); 418-425.

QUESTIONS?
FOLLOW UP AND NEXT STEPS

• You will receive a follow-up email from MDAAP with:
  – PPT slides from today and a recording of the session
  – Link to the post-session SurveyMonkey

• Next Steps:
  – Complete your PDSA form and return to troy_a_jacobs@hotmail.com and loretta@mdaap.org
  – Enter your data into QIDA
  – Next webinar/Didactic & QI Session #4 on Wednesday, January 4, 2023, at 12-1p ET
THANKS FOR TAKING CARE OF OUR MARYLAND KIDS!