Session 5: Clinical Management of the Child with Elevated Blood Lead Levels
ACKNOWLEDGMENTS

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- 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, and Paul Rogers, MD, FAAP
• QI Data Review – Troy Jacobs, MD, FAAP
• Case Presentation – Paul Rogers, MD, FAAP
  – with special guest: Clifford Mitchell, MS, MD, MPH (Director, Environmental Health Bureau, Maryland Department of Health)
• Case Discussion – All
• Follow Up and Next Steps – Loretta I. Hoepfner
Clinical Management of the Child with Elevated Blood Lead Levels

Paul T. Rogers MD MBA FAAP
Michael Ichniowski MD FAAP

February 1, 2023
DISCLOSURES

• In the past 12 months, we have no relevant financial relationships with the manufacturer(s) of any commercial product(s) and/or provider(s) of commercial services discussed in this CME activity.

• We do not intend to discuss an unapproved/investigative use of a commercial product/device in this presentation.
Prevent further exposure

Test any other children in the house

Work with local health department

Parent education: nutrition, hazard reduction, abatement

Neurodevelopmental assessment, referrals (IEP/HeadStart)

Refer for chelation when indicated

Roles for the Pediatric Provider in Managing the Child with EBL
**FOLLOW-UP MEDICAL MONITORING**

- **Confirmatory testing**
  - Capillary testing would be considered the first test to determine if the child has an elevated blood lead level.
  - If above 3.5 µg/dL, this should be repeated with a venous sample.
  - If venous is below 3.5 µg/dL, lead may still be in the environment, and education on sources of lead is still needed for primary prevention.

- **Repeat testing**
  - If child has had EBLL confirmed by venous testing, all further testing should be by venous sampling.
GUIDELINES FROM MARYLAND DEPARTMENT OF HEALTH FOR FOLLOW-UP BIOMONITORING

<table>
<thead>
<tr>
<th>Blood Lead Level (µg/dL)</th>
<th>Time to Confirmation Testing</th>
<th>Venous Blood lead Levels (µg/dL)</th>
<th>Early follow up testing (2-4 tests after identification)</th>
<th>Later follow up testing after BLL declining</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥3.5–9</td>
<td>Within 3 months*</td>
<td>≥3.5–9</td>
<td>3 months**</td>
<td>6–9 months</td>
</tr>
<tr>
<td>10–19</td>
<td>Within 1 month*</td>
<td>10–19</td>
<td>1–3 months**</td>
<td>3–6 months</td>
</tr>
<tr>
<td>20–44</td>
<td>Within 2 weeks*</td>
<td>20–44</td>
<td>2 weeks–1 month</td>
<td>1–3 months</td>
</tr>
<tr>
<td>≥45</td>
<td>Within 48 hours*</td>
<td>≥45</td>
<td>As soon as possible</td>
<td>As soon as possible</td>
</tr>
</tbody>
</table>

*The higher the BLL on the initial screening capillary test, the more urgent the need for confirmatory testing using a venous sample.

*Seasonal variation of BLLs exists and may be more apparent in colder climate areas. Greater exposure in the summer months may necessitate more frequent follow ups.

**Some case managers or healthcare providers may choose to repeat blood lead tests on all new patients within a month to ensure that their BLL level is not rising more quickly than anticipated.
CONFIRMED BLOOD LEVEL IS < 3.5 µg/dL

Provide education about common sources of lead exposure and information on how to further prevent exposure.

During well-child visits, check development to make sure age-appropriate milestones are being met.

During well-child visits, discuss diet and nutrition with a focus on iron and calcium intake.

Conduct follow-up blood lead testing at recommended intervals based on the child’s age.

Adopted from CDC Recommended Actions Based on Blood Lead Level
https://www.cdc.gov/nceh/lead/advisory/acclpp/actions-blls.htm
CONFIRMED BLOOD LEVEL IS 3.5-19 µg/dL

- Follow the recommendations above for BLL < 3.5 µg/dL
- Arrange for an environmental investigation of the home for BLL ≥ 5 µg/dL
- Rule out iron deficiency anemia
- Follow-up venous blood test within 3 months
Perform a complete history and physical exam, assessing the child for signs and symptoms related to lead exposure.

Consider performing an abdominal X-ray to check for radiopaque foreign bodies in child with moderate to severe pica.

Contact Maryland Poison Center (1-800-222-1222) for guidance.

CONFIRMED BLOOD LEVEL IS 20-44 µg/dL

Follow the recommendations above for BLL of 3.5-19 µg/dL
CONFIRMED BLOOD LEVEL IS > 45 µg/dL

Follow the recommendation above for BLL of 20-45 µg/dL

Evaluate patient for signs or symptoms of severe lead poisoning, including, confusion, weakness, seizures, coma, nausea, vomiting, and abdominal pain, which requires immediate hospitalization

Consult a medical toxicologist or pediatrician with experience in treating lead poisoning to initiate chelation therapy.

Contact Maryland Poison Center (1-800-222-1222) for assistance with acutely or chronically elevated blood lead levels

https://mdpoison.com/
TOXICOKinetics OF Lead PoISONING

- 50% of ingested lead absorbed by GI tract
- 5% of the lead enters the brain
- 1% of the lead remains in the blood stream
- ~80% of the lead is sequestered in the bones
Impairs BBB

Cell Death

Impairs Glial Cell Function

Disrupts Pruning Process

Impairs Neurotransmitters

Frontal Lobe Particularly Vulnerable

Child < Six Years Old

Effects of lead poisoning on the developing brain

EPA ISA 2013: https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=255721
NEUROPSYCHOLOGICAL IMPAIRMENTS DUE TO LEAD POISONING

Loss of IQ points

ADHD

Learning disabilities

Neurobehavior Disorders

EPA ISA 2013: https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=255721
**MEDICAL DISORDERS ASSOCIATED WITH LEAD POISONING**

1. Dental caries: consider more frequent dental check-ups

2. Anemia: monitor CBC and Ferritin levels

3. Hypertension: continue to check blood pressure at well visits

4. Delayed puberty: monitor sexual development

5. Hearing loss: hearing screening at well child visits

6. Growth retardation: monitor growth at well child visits

7. Sleep disorders: administer sleep questionnaire at well child visits


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3. EPA Integrated Science Assessment for Lead 2013, pg 1-7 at [www.epa.com](http://www.epa.com).


5. EPA Integrated Science Assessment for Lead 2013, pg 1-85 at [www.epa.com](http://www.epa.com).


MANAGEMENT OF THE CHILD WITH LEAD POISONING
CHELATION

Recommended for children with EBL ≥ 45 µg/dL

Contact Maryland Poison Control Center
(800) 222-1222
**Nutritional Guidance**

**Calcium:** Milk, orange juice, yogurt, cheese

**Iron:** Meats, Fe-fortified cereals, shellfish, lentils, spinach

**Magnesium:** Cereal, soy milk, peanuts, almonds

**Vitamin D & C:** Sunlight, dairy, tuna, salmon, cod, mushrooms, orange juice, grapefruit juice

See EPA Fight Lead Poisoning With a Healthy Diet
MDE or Pediatrician notifies HD of a child with a blood lead level ≥ 3.5 µg/dL

Telephone call to family to describe services

Educate family about lead poisoning and management

Refer families when indicated to community services

Home visit when indicated

Coordinate care with child’s Pediatrician

List of Local Health Departments in Maryland
https://www.naccho.org/membership/lhd-directory?searchType=standard&lhd-state=MD

Worcester County Health Department
1. Interview property owner

2. Visual inspection

3. Test for lead-based paint hazards: XRF and dust swipes

MD threshold $\geq 0.7 \, \mu g/dL$

MD threshold $\geq 10 \, \mu g/ft^2$

4. Water and soil sampling

5. Evaluate other properties child visits: day care, relatives

6. Summary and recommendations

THE ENVIRONMENTAL INVESTIGATION

MD threshold 0 ppb
MD threshold 400 ppm
**CONTROLLING LEAD HAZARDS IN THE HOME**

**Abatement**: the elimination of lead-based paint hazards to last 20 years

**Interim controls**: temporary measures to reduce exposure to lead-based paint hazards

CONTROLLING LEAD HAZARDS IN THE HOME: INTERIM CONTROLS FOR FAMILIES

- Shoes off at threshold
- Keep windows closed
- Frequent wet mopping/swiffering around doors/windowsills/baseboards
- Frequent dusting/HEPA vacuum
- Frequent hand washing
- Wash toys, bottles, pacifiers often

CONTROLLING LEAD HAZARDS IN THE HOME: DIY

1. Set up Safely
2. Protect Yourself
3. Minimize Dust
4. Leave Your Work Area Clean

Resource: EPA Lead-Safe Renovations for DIYers
https://www.epa.gov/lead/lead-safe-renovations-diyers
<table>
<thead>
<tr>
<th>Neurodevelopmental Assessment and Management</th>
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<tbody>
<tr>
<td>1. Screen for Neurodevelopmental Disabilities</td>
</tr>
<tr>
<td>2. Neuropsychological testing</td>
</tr>
<tr>
<td>3. Behavior Counseling, Parent skills training</td>
</tr>
<tr>
<td>4. Educational testing</td>
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<tr>
<td>5. Vocational evaluation</td>
</tr>
</tbody>
</table>

**AAP:** American Academy of Pediatrics

**DORS:** Department Of Rehabilitation Services

**ICF:** International Classification of Functioning, Disability and Health
RESOURCES

- Locate Certified Inspection, Risk Abatement, and Abatement Firms: https://cfpub.epa.gov/flpp/pub/index.cfm?do=main.firmSearchAbatement
- Lead Hazard Reduction Grant and Loan Program: https://dhcd.maryland.gov/Residents/Pages/lhrglp/default.aspx
- Mt. Washington Hospital Lead Treatment Program: https://www.mwph.org/health-services/lead-treatment, Telephone: 410-367-2222
- Neuropsychological testing:
  - MWPH Telephone: 410-367-2222
  - Kennedy Krieger Institute Telephone: 443-923-9400
## Resources — Continued

<table>
<thead>
<tr>
<th>Item</th>
<th>Website</th>
<th>QR Code</th>
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## Resources – Continued

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<th>QR Code</th>
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<tr>
<td>MDH Lead program</td>
<td><a href="https://phpa.health.maryland.gov/OEHFP/EH/Pages/Lead.aspx">https://phpa.health.maryland.gov/OEHFP/EH/Pages/Lead.aspx</a></td>
<td><img src="image1.png" alt="QR Code" /></td>
</tr>
<tr>
<td>New MDH programs for children with lead exposure who are enrolled in or eligible for Medicaid/MCHIP</td>
<td><a href="https://phpa.health.maryland.gov/OEHFP/EH/Pages/CHIPEnvCaseMgmt.aspx">https://phpa.health.maryland.gov/OEHFP/EH/Pages/CHIPEnvCaseMgmt.aspx</a></td>
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## Resources – Continued

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QI DATA REVIEW

Troy A. Jacobs, MD, MPH, FAAP
# 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>
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<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>
Blood Lead Testing

Cycle 1
- Greenspring Pediatric Associates: Cycle 1 (N = 7)
- MENCHAVEZ Pediatrics: Cycle 1 (N = 7)
- Sanchez Pediatrics: Cycle 1 (N = 4)
- University of Maryland Shore Medical Group-Pediatrics: Cycle 1 (N = 9)

Cycle 2
- Greenspring Pediatric Associates: Cycle 2 (N = 11)
- MENCHAVEZ Pediatrics: Cycle 2 (N = 6)
- Sanchez Pediatrics: Cycle 2 (N = 13)
- University of Maryland Shore Medical Group-Pediatrics: Cycle 2 (N = 11)

Cycle 3
- Greenspring Pediatric Associates: Cycle 3 (N = 13)
- MENCHAVEZ Pediatrics: Cycle 3 (N = 4)
- Sanchez Pediatrics: Cycle 3 (N = 9)
- University of Maryland Shore Medical Group-Pediatrics: Cycle 3 (N = 6)

Cycle 4
- Greenspring Pediatric Associates: Cycle 4 (N = 9)
- MENCHAVEZ Pediatrics: Cycle 4 (N = 9)
- Sanchez Pediatrics: Cycle 4 (N = 0)
- University of Maryland Shore Medical Group-Pediatrics: Cycle 4 (N = 13)

Cycle 5
- Greenspring Pediatric Associates: Cycle 5 (N = 0)
- MENCHAVEZ Pediatrics: Cycle 5 (N = 5)
- Sanchez Pediatrics: Cycle 5 (N = 0)
- University of Maryland Shore Medical Group-Pediatrics: Cycle 5 (N = 11)

Cycle 6
- Greenspring Pediatric Associates: Cycle 6 (N = 0)
- MENCHAVEZ Pediatrics: Cycle 6 (N = 0)
- Sanchez Pediatrics: Cycle 6 (N = 0)
- University of Maryland Shore Medical Group-Pediatrics: Cycle 6 (N = 5)
Blood Lead Results Interpretation (Follow Up Testing)

- **Greenspring Pediatric Associates**
  - Cycle 1 (N = 1)
  - Cycle 2 (N = 1)
  - Cycle 3 (N = 3)
  - Cycle 4 (N = 2)
  - Cycle 6 (N = 0)

- **MENCHAVEZ Pediatrics**
  - Cycle 1 (N = 0)
  - Cycle 2 (N = 0)
  - Cycle 3 (N = 0)
  - Cycle 4 (N = 0)
  - Cycle 6 (N = 0)

- **Sanchez Pediatrics**
  - Cycle 1 (N = 0)
  - Cycle 2 (N = 0)
  - Cycle 3 (N = 0)
  - Cycle 4 (N = 0)
  - Cycle 5 (N = 0)
  - Cycle 6 (N = 0)

- **University of Maryland Shore Medical Group Pediatrics**
  - Cycle 1 (N = 0)
  - Cycle 2 (N = 1)
  - Cycle 3 (N = 1)
  - Cycle 4 (N = 0)
  - Cycle 5 (N = 1)
  - Cycle 6 (N = 0)
QUESTIONS?
CASE PRESENTATION

Paul Rogers, MD, FAAP
Dana Silver, MD, FAAP
C/C: This seven-month-old boy had a venous blood lead level 22 µg/dL. His sister had a venous lead level of 9 µg/dL drawn one month earlier.

The property: This “Historical Victorian Charmer” was built in 1900 with no recent history of remodeling and is in Hampstead, Carroll County. Father has done some welding, but no other lead hazard exposure identified.

PMHx: Non-contributory
CASE DISCUSSION WITH CLIFF MITCHELL, MS, MD, MPH
(DIRECTOR, ENVIRONMENTAL HEALTH BUREAU, MDH)

1. Blood Lead Testing and Reporting
2. Follow-up testing of child with an elevated BLL
3. ImmuNet/Childhood Lead Registry
4. State resources and resources for children with lead poisoning
5. Advice for providers from recent evaluation
BLOOD LEAD TESTING CONSIDERATIONS

• All children in Maryland must be offered testing for blood lead at 12 month and 24 month visits (COMAR 10.11.04)

• Blood lead testing requisitions – must contain information specified in COMAR 26.02.01.02

• All lead tests of children 18 years or younger must be reported to MDE (COMAR 26.02.01)
No environmental investigations for BLLs <5 µg/dL until 1/1/2024

STATE RESOURCES FOR CHILDREN WITH LEAD POISONING

• Home Visiting Programs in Local Health Departments

• Maryland Department of the Environment
  – Health Care Provider pages, Parent pages

• Maryland Department of Health
  – Lead pages, Lead Mapping (Environmental Tracking)

• Lead abatement programs
  – State, local programs

• Non-governmental organizations
Lead values available from Childhood Lead Registry – report can be used in place of MDH Form 4620 for parents for pre-kindergarten, kindergarten, and first grade.
• Maryland evaluated the impacts of moving from targeted testing to universal testing in 2016

• COVID-19 interrupted improved testing rates, along with the rest of health care
Figure 1. Annual number of children tested for blood lead at age 12 months, 24 months, and all other ages less than 72 months, 2010 - 2020.
MARYLAND should continue the current strategy of defining the entire state as at risk and continue to test all children at 12 and 24 months of age. MDH and MDE should analyze the distribution of blood lead levels from January, 2023 forward in re-evaluating the state’s testing strategy. At least three years of data will be required to assess the strategy and impacts of other changes underway in lead poisoning prevention in the state.
MDH and MDE should work with the provider community to increase testing rates, and improve provider reporting of blood lead test results and data on race and ethnicity.
The new BLRV of 3.5 µg/dL will result in an increase in the number of children who require some clinical and/or case management follow up, and state agencies need to carefully evaluate the messaging, effort, resources, and health equity implications of these changes.
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
  – Complete your Case Presentation form and return to michich23@hotmail.com, mdpaul5381@aol.com, and loretta@mdaap.org
  – Next webinar/Didactic & QI Session #6 on Wednesday, March 1, 2023, at 12-1p ET – Register at https://us02web.zoom.us/meeting/register/tZAsdeitpj4oHtPrLxWgttl8_Ucb4ehgSABr
THANKS FOR TAKING CARE OF OUR MARYLAND KIDS!