Clinical Innovations in Lead Testing and Management

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This presentation was developed for educational purposes only. Decisions about evaluation and treatment are the responsibility of the treating clinician and should always be tailored to individual clinical circumstances.
DISCLAIMER

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BACKGROUND AND OVERVIEW

- In the U.S., 1 in 4 homes have significant lead paint hazards. (Jacobs, 2002)

- 500,000 (2.5%) of U.S. children, ages 1-5 have levels above the CDC reference level (Ettinger, 2019)
UNMET NEEDS

• “Lead Exposure is a local problem with local solutions;” often health care providers will seek national resources for evidence-based guidelines.

• Variability in recommendations based on sociodemographic and geographic factors makes lead different than many other clinical conditions.
  – Funding Sources
  – Patient Insurance Status

Ettinger, 2019
Learning Objectives

By the end of this webinar, participants will be able to:

• Recognize the degree of variability and complexity in lead testing and management recommendations across the United States.
• Recognize that competing recommendations exist for lead testing and management on the local level between health department, national priorities, and insurance mandates.
• Explain how lead testing rates can be impacted by targeting clinical decision support to align with local recommendations.
• Understand how to align competing evidence-based recommendations in a clinical decision support tool.
• Explain how lead management can be impacted by targeting clinical decision support to align with local recommendations.
BACKGROUND: Variability in Lead Testing and Management Guidelines
MORE GUIDELINES THAN STATES

• Reputable guidance for lead testing and management is crucial to supporting public health efforts to combat increasing lead exposure and undetected toxicity.
• Multiple agencies have developed lead screening, testing and management recommendations.
• Differing recommendations across agencies and guidelines would present challenges to providing equitable care and to the development of shareable clinical decision support (CDS).
MORE GUIDELINES THAN STATES

Methods

– We reviewed publically available lead screening, testing and management guidance from states, professional societies, government agencies, and counties.

– We extracted definitions for elevated lead, screening and testing requirements, reporting requirements, and management recommendations.

– We evaluated different lead thresholds and level of obligation at which each management activity was recommended.

– We assessed feasibility for conversion of recommendations into shareable CDS.
MORE GUIDELINES THAN STATES

• How many guidance sources?
  – 54 lead screening, testing and management guidance sources

• How many levels?
  – Federal/National guidance (4)
  – State* specific guidance (48)
  – County/city specific guidance (2)
  – Insurance ‘mandates’

*Also includes the District of Columbia
MORE GUIDELINES THAN STATES

- States provided different definitions for elevated lead.

Definitions of ELL for 50 US States and District of Columbia

<table>
<thead>
<tr>
<th>ELL Definition (N = 51)</th>
<th>States</th>
</tr>
</thead>
<tbody>
<tr>
<td>No level specified (3)</td>
<td>Arkansas, North Dakota, Wyoming</td>
</tr>
<tr>
<td>Lead Level ≥ 3 mcg/dL (1)</td>
<td>New Hampshire</td>
</tr>
<tr>
<td>Lead Level ≥ 5 mcg/dL (37)</td>
<td>Alabama, Alaska, Arizona, California, Colorado, Connecticut, District of Columbia, Georgia, Hawaii, Idaho, Illinois, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Montana¹, Nebraska, New Mexico, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, Washington, Wisconsin</td>
</tr>
<tr>
<td>Lead Level ≥ 10 mcg/dL (10)</td>
<td>Delaware, Florida, Indiana, Kansas, Missouri, Nevada, New Jersey, New York², Utah, West Virginia</td>
</tr>
</tbody>
</table>

¹ Montana does not provide screening guidance, but ELL is defined in the ‘reportable disease’ list as ≥ 5 mcg/dL
² New York City defines ELL as ≥ 5 mcg/dL, however the rest of New York State uses ELL as ≥ 10 mcg/dL
MORE GUIDELINES THAN STATES

- Blood Level Testing
  - Capillary and venous testing were both considered acceptable.
  - Universal testing is recommended by CMS (at 1 and 2 years old), PEHSU, 14 states, the District of Columbia, and Philadelphia (the rest of Pennsylvania has targeted testing).
  - Most recommend 2 testings (Delaware = 1, Massachusetts = 3, Idaho=5)
MORE GUIDELINES THAN STATES

• Reporting
  – The majority (n=43) mandated reporting of all lead results.
  – For 7 states, reporting was mandated only for elevated lead levels.
  – For one state we could not identify any reporting requirement.
MORE GUIDELINES THAN STATES

- Clinical Management Actions
  - Across the 54 guidance sources, 79% (n=43) described clinical care actions.
  - We identified 17 distinct management recommendations.
  - The recommended lead threshold for a clinician to perform an action varied widely across sources for the same clinical activity.
  - Recommendations also varied in obligation to perform (may vs. should).
  - Recommendations were generally clear, unambiguous, and actionable.
  - Most (15/17) were directed at the clinician-patient encounter.
More Guidelines Than States

- Follow up testing
  - 40 (74%) guidance sources addressed follow up lead testing
  - States discussing elevated capillary values indicated venous confirmation.
  - Many states recommended confirmation (second test) before diagnosis.
  - Confirmation intervals varied widely, ranging from 24 hours to 3 months.
  - Recommendations for monitoring lead levels after diagnosis varied.
  - Monitoring recommendations based on most recent lead level, location, specimen source, and overall trend.
MORE GUIDELINES THAN STATES

• To test or not to test
  – Do previous results exist that indicate testing is needed?
    ▪ Test as per monitoring or confirmation testing policies
  – Does the patient need testing because of attributable risks?
    ▪ Disclosure of risk or family member with elevated screening results
  – Does a universal testing policy exist at this visit (age based testing)?
    ▪ State policy
    ▪ County policy (Philadelphia)
    ▪ Insurer policy (all Medicaid and some CHIP plans [if EPSDT])
  – Does the family request testing?
MORE GUIDELINES THAN STATES

• Limited variables needed to determine whether to test.
  – Patient Age
  – Insurer (EPSDT or no)
  – Office Location (State and Zip Code)
  – Most Recent Lead Test (Specimen type and result)
  – Other Previous Lead Tests (Specimen result)
Clinical Innovation: Improving Testing using the EHR
Lead Testing QI Project

• Our office was not testing many children according to local and insurance supported policies.
  – Universal testing at age 9 months and 24 months.
  – Testing of children ages 36-72 months if never previously tested.

• EHR provided some support for testing
  – Lead test selection required during the 9 month and 24 month well child visit for children with EPSDT insurance.
  – Cannot sign the order set without selecting a lead test or indicating testing is not indicated.
LEAD TESTING QI PROJECT

• SMART AIM
  – Improve testing rates across all age-groups from baseline to 88%, the current screening rate in 9-12 month olds, within 3 months.
LEAD TESTING QI PROJECT

CHOP QI Framework (Define, Diagnose, Test)

- Define & Diagnose
  - Identified a gap in care (children are not being tested for lead).
  - Used a driver diagram to identify key factors preventing testing.
  - Developed a process map to identify potential targets of intervention.
  - Used an impact-effort matrix to select achievable interventions.

- Test
  - Selected interventions to target our initial goal of improved testing.
  - Created balancing measures to monitor for unintended consequences.
LEAD TESTING QI PROJECT

• Numerous drivers
  – Missed visits
  – Lack of appropriate EHR support
  – Patients not going to the (onsite) lab
  – Too long a wait (perceived)
  – Too much waiting during the visit already
  – Child is already dressed and not wanting to undress again
  – Patient refusal of testing (variable reasons)
LEAD TESTING QI PROJECT

- Impact-Effort Matrix

- Interventions
LEAD TESTING QI PROJECT

• EHR Intervention (Intervention 1)
  – Add preselected lead order to the well visit order sets for our practice.
  – Hide if previous lead tests (unless 24-36 months and due for #2)

• Remember, limited variables needed
  – Patient Age
  – Insurer (EPSDT or no)
  – Office Location (State and Zip Code)
  – Most Recent Lead Test (Specimen type and result)
  – Other Previous Lead Tests (Specimen result)
**LEAD TESTING QI PROJECT**

**Lead Test Ordering (Weekly)**

![Graph showing lead test ordering rates with control limits and intervention points.](image)

- **Weeks:** Week 1 (n=91), Week 3 (n=75), Week 5 (n=82), Week 7 (n=65), Week 9 (n=51), Week 11 (n=34), Week 13 (n=73), Week 15 (n=80), Week 17 (n=73), Week 19 (n=76), Week 21 (n=60), Week 23 (n=96), Week 25 (n=74), Week 27 (n=94), Week 29 (n=32), Week 31 (n=30), Week 33 (n=67), Week 35 (n=104), Week 37 (n=83), Week 39 (n=80), Week 41 (n=84), Week 43 (n=54), Week 45 (n=77), Week 47 (n=77), Week 49 (n=64), Week 51 (n=64)

- **Test Ordering Rates (% children due):**
  - **Lower Control Limit:** 50
  - **Upper Control Limit:** 100

**PRELIMINARY DATA**

Intervention 1 Started
LEAD TESTING QI PROJECT

• Continuing Interventions
  – Working with our patient education department to develop a handout nurses can give to improve awareness.
  – Coordinating immunizations and phlebotomy for children who need both services at a visit.
Clinical Innovation: Improving the Response to Elevated Blood Lead Levels, the Development of an Evidence-Based Guideline
Background

- National and regional guidelines exist
- Providers may have difficulty in integrating and adapting these resources to intervene locally.
  - Different cut points for action recommendations
  - Perpetual updated guidelines
- Variability in primary care providers knowledge and practices
- Emerging evidence suggests great opportunity for reversal of negative outcomes previously associated with early life exposures through multidisciplinary early life interventions.

S. Billings – American Economic Journal July 2018
BACKGROUND
BACKGROUND

- **Aim:** To develop an evidence-based guideline (EBG) or a standardized process for testing and managing of elevated blood lead levels
Development of EBG

Baseline Data Jan 2015 – Jun 2016:

- Large Urban Academic Pediatric Primary Care Center
  - Testing Rates:
    - 9-12 months: 83%
    - 12-24 months: 86%
    - 24-36* months: 82%
    - Boston <36 months: 66%; Statewide < 36 months 59%

* Universal screening in MA: 1 yr, 2 yr, 3 yr and 4 yrs in 22 high risk communities
DEVELOPMENT OF EBG

- 42 children less than 4 years with elevated blood lead level (eBLL) (≥ 5 μg/dL)
- 17% of children with eBLLs had comorbid anemia
- 24% of patients were receiving or referred to Early Intervention prior to first eBLL.
- 83% of first eBLL ranged from 5-9 μg/dL.
DEVELOPMENT OF EBG

• 64% with eBLL had environmental history.
• 31% with eBLL environmental inspection referral.
• 33% prescribed iron supplementation.
  – 50% of these were prescribed empirically.
• 16% with eBLLs who were not already receiving early intervention services were referred.
• 43% of children with eBLLs had repeat BLL within recommended timeframe based on eBLL.
RX FOR MULTIDISCIPLINARY MANAGEMENT

- Environmental History
- Home Inspection
- Sustainable Lead Hazard Remediation
- Development
- Nutrition & Iron Supplementation
- Repeat Blood Lead Level within recommended time frame
- +/- Chelation Therapy
**Development of EBG**

**Universal Lead Screening in MA**

All children in Massachusetts should be screened annually for lead poisoning at 9-12 months, 2 years and 3 years. For high risk communities, children should be screened at 4 years old.

MA DPH Childhood Lead Poisoning Prevention Program www.mass.gov/dph/clppp

**1 Blood Lead Levels ≥5**

There is no safe blood lead level. A blood lead level ≥5 μg/dL is the CDC reference blood lead level that public health actions be initiated.
DEVELOPMENT OF EBG

2 Iron and Lead

Lead competes for absorption with iron, calcium and other cations in the GI tract.
If patient anemic, prescribe iron supplementation
Obtain iron studies at repeat blood test for all children with elevated lead levels.

4 Early Intervention

Lead is a neurotoxin that affects the developing brain.

 Approximately 85% of children in MA with elevated blood lead levels qualify for early intervention. Consider referral early and often! Encourage activities that promote development!
3 Environmental History

Call for a home lead education visit and environmental inspection:
MA Department of Health
(1-800-532-9571)
Boston Public Health Commission
(617.534.5966)
or hire private Lead Inspection

Conduct an Environmental History by Asking about common sources of lead exposure
(Risk Assessment Checklist)

STOP

Stop any ongoing renovations in homes!
Renovations in homes built pre 1978 should be done by lead-certified contractors

Encourage Temporary Abatement Measures
1) Wash Hands Frequently
2) Shoes off at door
3) Put Duct Tape over chipping pealing paint
4) Reduce occupational take home exposure by changing out of lead-related work clothes and shoes before going home

MA DPH Understanding Lead Poisoning http://1.usa.gov/25Y5f7X
Development of EBG

Schedule Repeat Blood Level

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Schedule repeat lead level!
Timeline will vary based on severity! Consult EBG.

VS

Refer patients to BCH Pediatric Environmental Health Center
OR
Call 617.355.8177 or page physician on call through paging system with any ?s!
IMPLEMENTATION OF EBG

• Despite development of EBG, there are still many barriers to implementation of multidisciplinary management of elevated blood lead levels

• Evidence suggests that responding to elevated blood lead levels can have positive individual neurodevelopmental outcomes
CONCLUSION

- More work is needed to develop and study the effectiveness of clinical innovations in both the screening, testing, and management for elevated blood lead levels.
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DISCUSSION