Cost-Benefit Analyses of Policies to Prevent & Remediate Childhood Lead Exposure

Corey Rhyam and George Miller
Altarum Institute
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Presentation Plan

▲ Introductions

▲ National-Level Analyses (published August 2017)

▲ State and City Analyses (ongoing project)

▲ Questions and Discussion
Introductions

▲ Altarum Institute
  - Health-focused research and consulting institute, headquartered in Ann Arbor, Michigan
  - Aim is to advance health for vulnerable and publicly-insured populations through research, analytics, technology solutions, and program implementation

▲ Corwin (Corey) Rhyan, MPP
  - Senior Analyst, Center for Value in Health Care

▲ George Miller, PhD
  - Senior Fellow and Research Team Leader, Center for Value in Health Care
National Policy Analyses

Partnership of:
- Robert Wood Johnson Foundation
- The Pew Charitable Trusts
- Health Impact Project
- Child Trends
- Altarum Institute
- Urban Institute
- Trust for America’s Health
- National Center for Healthy Housing
- External Experts and Reviewers
National Policy Analyses - Results

- Estimated Economic Impact of Lead Exposure for Children born in 2018:
  - $84.0 billion dollars
Estimated Economic Impact of Lead Exposure for Children born in 2018:
- $84.0 billion dollars
National Policy Analyses – Results

▲ Policy #1: Residential Lead Service Line Replacement
   ▪ Protect 350,000 children and yield $2.7B in benefits ($1.33 per dollar invested)

▲ Policy #2: Residential Lead Hazard Control
   ▪ Protect 311,000 children and yield $2.8B in benefits ($1.39 per dollar invested)

▲ Policy #3: Enforcement of the federal lead-safe renovation, repair, and painting rules
   ▪ Protect 211,000 children and yield $4.5B in benefits ($3.10 per dollar invested)

▲ Policy #4: Eliminating lead from all airplane fuel
   ▪ Protect 226,000 children and generate $262 million in future benefits
Modeling Choices

- Focused on primary prevention of lead exposure
- Limited interventions to a single-year birth cohort (2018)
- Benefits limited to initial child and future residents for ten years
- Policy “costs” limited to intervention costs
- Multiple model runs for different assumptions
  - Scale of the intervention
  - Lead Exposure assumptions
# Lead Service Line Replacement – Results

## Table 3

<table>
<thead>
<tr>
<th>Initial cohort</th>
<th>Gross future benefits</th>
<th>Future cohorts (through year 10)</th>
<th>Total gross future benefits</th>
<th>Share to federal government</th>
<th>Share to state and local governments</th>
<th>Share to households, the private sector, and other nongovernmental entities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earnings</td>
<td>$2.0 billion</td>
<td>$550 million</td>
<td>$2.7 billion</td>
<td>$480 million</td>
<td>$250 million</td>
<td>$2.0 billion</td>
</tr>
<tr>
<td>Health savings</td>
<td>$40 million</td>
<td>$10 million</td>
<td>$40 million</td>
<td>$10 million</td>
<td>$5 million</td>
<td></td>
</tr>
<tr>
<td>Education savings</td>
<td>$50 million</td>
<td>$20 million</td>
<td>$50 million</td>
<td>$20 million</td>
<td>$5 million</td>
<td></td>
</tr>
<tr>
<td>Quality-adjusted life years benefits</td>
<td>$80 million</td>
<td>$30 million</td>
<td>$80 million</td>
<td>$30 million</td>
<td>$5 million</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$2.0 billion</strong></td>
<td><strong>$640 million</strong></td>
<td><strong>$2.7 billion</strong></td>
<td><strong>$860 million</strong></td>
<td><strong>$630 million</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Every Dollar Invested in Full Lead Service Line Replacement Would Generate $0.42 to $1.33 in Benefits**

Cost-benefit analysis, for two initial water lead levels
Lead Service Line Replacement – Results

**Table 3**

_Every Dollar Invested in Full Lead Service Line Replacement Would Generate $.42 to $1.33 in Benefits_  
Cost-benefit analysis, for two initial water lead levels

<table>
<thead>
<tr>
<th>Costs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing cost per potential lead service line</td>
<td>$175</td>
</tr>
<tr>
<td>Total testing cost</td>
<td>$410 million</td>
</tr>
<tr>
<td>Full lead service line replacement cost per home</td>
<td>$6,000</td>
</tr>
<tr>
<td>Full lead service line replacement cost for all homes</td>
<td>$1.6 billion</td>
</tr>
<tr>
<td><strong>Total costs</strong></td>
<td><strong>$2.0 billion</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Net</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Net future benefits</td>
<td>$680 million</td>
</tr>
<tr>
<td>Cost-benefit ratio</td>
<td>1.33</td>
</tr>
<tr>
<td></td>
<td>-1.2 billion</td>
</tr>
<tr>
<td></td>
<td>0.42</td>
</tr>
</tbody>
</table>
National Analyses - Methods
Key Model Inputs

▲ Lead Exposure Risk Predictors
  ▪ Housing Stock Age
  ▪ Lead Service Line Count Estimates
  ▪ Water and Dust Lead Concentrations
  ▪ Lead Exposure Health and IQ Impacts

▲ Population Characteristics
  ▪ Baseline Blood Lead Levels
  ▪ Earnings, Health Care Insurance/Costs

▲ Policy Data
  ▪ Intervention Effectiveness Data
  ▪ Intervention Cost Data

Typical Data Sources

▲ National Estimates
  ▪ National Surveys and Statistics

▲ State Estimates
  ▪ State Data and Imputation

▲ City Estimates
  ▪ City-Specific Data
State-Level Estimates

▲ Imputation of Blood Lead Levels

<table>
<thead>
<tr>
<th></th>
<th>Colorado</th>
<th>Pennsylvania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. Age (Months)</td>
<td>23.53</td>
<td>23.56</td>
</tr>
<tr>
<td>Year</td>
<td>2018</td>
<td>2018</td>
</tr>
<tr>
<td>% Below Pov. Line</td>
<td>11.0%</td>
<td>12.9%</td>
</tr>
<tr>
<td>% Pre-60 Housing</td>
<td>18.2%</td>
<td>47.2%</td>
</tr>
<tr>
<td>% Non-Hisp. Black</td>
<td>4.7%</td>
<td>11.6%</td>
</tr>
</tbody>
</table>

Intercept: 0.3514
Average Child Age - Months: 0.0113
Year of Sampling: -0.049
Percentage Below Poverty Line: 0.6765
Percentage of Pre-1960 Housing: 0.3999
Percentage of Pop that is Non-Hispanic Black: 0.2277
State-Level Estimates

State Risk-Factor Variation

Percent of Homes Built Before 1960 (# of States)

Percent of Population with a LSL (# of States)
### State-Level Estimates

<table>
<thead>
<tr>
<th></th>
<th>Colorado</th>
<th>Pennsylvania</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of children above 2 ug/dL</td>
<td>5.9%</td>
<td>9.2%</td>
</tr>
<tr>
<td>Keep all BLLs at Zero</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Benefits</td>
<td>$1.5 B</td>
<td>$2.9 B</td>
</tr>
<tr>
<td>Earnings</td>
<td>$1.3 B</td>
<td>$2.7 B</td>
</tr>
<tr>
<td>QALYs</td>
<td>$30 M</td>
<td>$100 M</td>
</tr>
<tr>
<td>Health</td>
<td>$40 M</td>
<td>$80 M</td>
</tr>
<tr>
<td>Education</td>
<td>$30 M</td>
<td>$60 M</td>
</tr>
<tr>
<td>Federal Gov’t Benefits</td>
<td>$410 M</td>
<td>$880 M</td>
</tr>
<tr>
<td>State Gov’t Benefits</td>
<td>$190 M</td>
<td>$400 M</td>
</tr>
<tr>
<td>Lead Service Line Replacement</td>
<td>$23 M (2,500 homes)</td>
<td>Lead Service Line Replacement $50 M (6,200 homes)</td>
</tr>
<tr>
<td>Lead Hazard Control (Pre-1960)</td>
<td>$110 M (9,300 homes)</td>
<td>Lead Hazard Control (Pre-1960) $539 M (51,400 homes)</td>
</tr>
<tr>
<td>Renovation, Repair and Painting Rule Enforcement</td>
<td>$62 M</td>
<td>Renovation, Repair and Painting Rule Enforcement $252 M</td>
</tr>
</tbody>
</table>
Ongoing Development

▲ Current Activities

- State-specific intervention cost estimates
- Estimation of program and administration costs
- Website construction and publication of results
- User customization of modeling
- Additional policy findings: removal of lead from schools and childcare centers
- City-level estimates once specific cities have been selected
Ongoing Development

▲ Website Development

- Results
  - Descriptive Statistics
  - Potential Economic Benefits of Lead Prevention Policies
  - Expected Cost-Benefit Ratio of those Interventions
  - Timeline and Distribution of those returns

- Customization
  - Intervention Size
  - Populations Impacted
  - Intervention and Program Costs
  - Underlying Model Assumptions
Questions and Discussion

▲ Questions?

▲ Discussion

- How can we maximize the usefulness of these analyses for advocates and policymakers?
- What results/findings are most important to report?
- What types of user customization are most important to include?

▲ Contact

- Corey Rhyan, Corwin.Rhyan@Altarum.org