Childhood Lead Poisoning in the 21st Century

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“The connection between health and the dwelling of the population is one of the most important that exists”.

*Florence Nightingale*
Adverse Health Effects in Children by Blood Lead Level

- Death
- Encephalopathy
- Nephropathy
- Frank anemia
- Colic
- Decreased hemoglobin synthesis
- Increased vitamin D metabolism
- Increased risk of hypertension in adulthood
- Increased nerve conduction velocity
- Increased level of erythrocyte protoporphyrin
- Decreased vitamin D metabolism
- Decreased calcium homeostasis
- Developmental toxicity
  - Decreased IQ level
  - Decreased hearing
  - Decreased growth
  - Impaired peripheral nerve function
  - Transplacental transfer

Source: ATSDR, 1992
Exposure to lead can seriously harm a child’s health.

- Damage to the brain and nervous system
- Slowed growth and development
- Learning and behavior problems
- Hearing and speech problems

This can cause:
- Lower IQ
- Decreased ability to pay attention
- Underperformance at school
Individuals with an IQ score between 50-70 are classified as moderately retarded.

Individuals with an IQ score between 125-144 are classified as gifted or highly gifted.

- Normal Distribution
- Shift in Average of 5 IQ points
- Shift in Average of 10 IQ points

UCLA, 2009
Brain volume loss in males (n=83)
mean blood lead level 13.6 µg/dL
highlighted over standard brain template

Brain volume loss in females (n=74)
mean blood lead level 13.1 µg/dL
highlighted over standard brain template

## Studies on Lead and Educational Outcomes

<table>
<thead>
<tr>
<th>Blood Lead Levels</th>
<th>Educational Impact</th>
<th>Size of Study</th>
<th>Location of Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 2 μg/dL</td>
<td>Decreased end of grade test scores</td>
<td>More than 57,000 children</td>
<td>North Carolina (Miranda et al. 2009)</td>
</tr>
<tr>
<td>4 μg/dL at 3 years of age</td>
<td>Increased likelihood learning disabled classification in elementary school</td>
<td>More than 57,000 children</td>
<td>North Carolina (Miranda et al. 2009)</td>
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<td>Poorer performance on tests</td>
<td>35,000 children</td>
<td>Connecticut (Miranda et al. 2011)</td>
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<tr>
<td>5 μg/dL</td>
<td>30% more likely to fail third grade reading and math tests</td>
<td>More than 48,000 children</td>
<td>Chicago (Evens et al. unpublished data)</td>
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<td>More likely to be non-proficient in math, science, and reading</td>
<td>21,000 children</td>
<td>Detroit (Zhang et al. 2013)</td>
</tr>
<tr>
<td>5-9 μg/dL</td>
<td>Scored 4.5 points lower on reading readiness tests</td>
<td>3,406 children</td>
<td>Rhode Island (McLaine et al. 2013)</td>
</tr>
<tr>
<td>≥10 μg/dL</td>
<td>Scored 10.1 points lower on reading readiness tests</td>
<td>3,406 children</td>
<td>Rhode Island (McLaine et al. 2013)</td>
</tr>
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<td>10 and 19 μg/dL</td>
<td>Significantly lower academic performance test scores in 4th grade</td>
<td>More than 3,000 children</td>
<td>Milwaukee (Amato et al. 2012)</td>
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<td>≥ 25 μg/dL</td>
<td>$0.5 million in excess annual special education and juvenile justice costs</td>
<td>279 children</td>
<td>Mahoning County, Ohio (Stefanak et al. 2005)</td>
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</table>
Impact of Lead Poisoning Prevention Policy on Reducing Children’s Blood Lead Levels

- **Lead-based Paint Poisoning Prevention Act** 1971
- **Lead Gasoline Phase-out** 1973
- **Lead limit in Residential & Decorative Paint: 600 ppm** 1978
- **Lead in Plumbing banned** 1986
- **Lead Contamination Control Act (Drinking Fountains), 1988**
- **Virtual Elimination of Lead in Gasoline** 1988
- **Ban on lead solder in food cans, 1995**
- **Residential Lead-Based Paint Hazard Reduction Act** 1992
- **Housing units with lead based paint hazards reduced by 40% since 1990**
- **Lead and Copper Rule** 1991
- **Renovation, Repair and Painting Rule (Lead Paint) 2008**
- **Safe Drinking Water Act** 1974
- **Lead Limit in Residential & Decorative Paint: Reduced to 90 ppm** 2009
- **Total Lead in Children’s Products limited to 100 ppm** 2011
- **Lead and Copper Rule***

Blood Lead Levels (µg/dL): 2.7% ≥ 10 µg/dL

Year:
Where do lead hazards come from?

Most lead hazards come from lead paint chips that have been ground into tiny bits.

These tiny bits of lead become part of the dust and soil in and around our homes.
1. Keep it Clean

2. Put Barriers between Children and Lead Paint

3. Find out about Foods that Help

4. Have your Child Tested for Lead
**Recommended actions based on BLL**

<table>
<thead>
<tr>
<th>&lt;Reference Value</th>
<th>≥Reference Value ≤45</th>
<th>≥45 ≤69</th>
<th>≥70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead education</td>
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<td>Lead education</td>
<td>Hospitalize and commence chelation therapy (following confirmatory venous blood lead test) in conjunction with consultation from a medical toxicologist or a pediatric environmental health specialty unit</td>
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<tr>
<td>- Dietary</td>
<td>- Dietary</td>
<td>- Dietary</td>
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<tr>
<td>- Environmental</td>
<td>- Environmental</td>
<td>- Environmental</td>
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<tr>
<td>Environmental assessment* for pre-1978 housing</td>
<td>Follow-up blood lead monitoring</td>
<td>Follow-up blood lead monitoring</td>
<td>Proceed according to actions for 45-69 µg/dL</td>
</tr>
<tr>
<td>Follow-up blood lead monitoring (see pages 23-24)</td>
<td>Complete history and physical exam</td>
<td>Complete history and physical exam</td>
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<tr>
<td>Lab work:</td>
<td>Lab work:</td>
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<td></td>
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<tr>
<td>- Iron status</td>
<td>- Iron status</td>
<td>- Hemoglobin or hematocrit</td>
<td></td>
</tr>
<tr>
<td>Consider Hemoglobin or hematocrit</td>
<td>- Iron status</td>
<td>- Free erythrocyte protoporphyrin</td>
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<tr>
<td>Environmental investigation</td>
<td>Environmental investigation</td>
<td>Environmental investigation</td>
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<tr>
<td>Lead hazard reduction</td>
<td>Lead hazard reduction</td>
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<tr>
<td>Neurodevelopmental monitoring</td>
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<tr>
<td>- Abdominal X-ray (if particulate lead ingestion is suspected) with bowel decontamination if indicated</td>
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<td>Oral Chelation therapy Consider hospitalization if lead-safe environment cannot be assured</td>
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</tr>
</tbody>
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*The scope of an "environmental assessment" will vary based on local resources and site conditions. However, this would include at a minimum a visual assessment of paint and housing conditions, but may also include testing of paint, soil, dust, water and other lead sources. This may also include looking for exposure from imported cosmetics, folk remedies, pottery, food, toys, etc. which may be more important with low level lead exposure.*

Brockton, Massachusetts
July, 2001
Prevent Childhood Lead Poisoning

The Impact

535,000
U.S. children ages 1 to 5 years have blood lead levels high enough to damage their health.

24 million
Homes in the U.S. contain deteriorated lead-based paint and elevated levels of lead-contaminated house dust. 4 million of these are home to young children.

It can cost $5,600 in medical and special education costs for each seriously lead-poisoned child.

Visit www.cdc.gov/nceh/lead to learn more.
Prevent Lead Poisoning
Get your child tested
Get your home tested
Get the facts

http://www.cdc.gov/nceh/lead
http://www.cdc.gov/HealthyHomes/programs.html

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention
National Center for Environmental Health
Lead poisoning is a problem we can fix.