The Lingering Legacy of Lead Toxicity

Why Even a Little Lead is Still Too Much
Measuring Brain Function

IQ
Cognition

Behaviors

Brain Imaging
Behavioral and Emotional Problems of Lead Exposure

<table>
<thead>
<tr>
<th>Class</th>
<th>Dentine Lead (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt;1.1</td>
</tr>
<tr>
<td>2</td>
<td>5.1 to 8.1</td>
</tr>
<tr>
<td>3</td>
<td>8.2 to 11.8</td>
</tr>
<tr>
<td>4</td>
<td>11.9 to 17.1</td>
</tr>
<tr>
<td>5</td>
<td>17.2 to 27.0</td>
</tr>
<tr>
<td>6</td>
<td>&gt;27.0</td>
</tr>
</tbody>
</table>
Reading Scores by Blood Lead Levels

LEAD EXPOSURE, even at very low levels, diminishes IQ.
Blood Lead Concentrations Considered Safe by the CDC

In 2012 the CDC declared “no safe level” of blood lead.
The Disastrous Impact of Toxic Chemicals On IQ
The Prevention Paradox

Estimated Loss of IQ in US Children at Different Intervals of Blood Lead
The Impact of Lead on Intellectual Ability
Residential Distance and Blood Lead Levels in Children <18 yrs

Predicted BLL (µ/dL)

Child Residential Distance from Reid Hillview Airport

<0.5 miles 0.5-1 mile 1-1.5 miles
Residential Distance and Blood Lead Levels in Toddlers and Children <18 years

![Graph showing predicted BLL (µ/dL) for different residential distances from Reid Hillview Airport.](image)

- **Children <18 yrs**
- **Toddlers**

Predicted BLL (µ/dL)

- <0.5 miles: 2.6
- 0.5-1 mile: 2.2
- 1-1.5 miles: 1.8

Child Residential Distance from Reid Hillview Airport
Piston Engine Aircraft Traffic x Residential Distance and Blood Lead Levels in Children < 18 yrs.
Piston Engine Aircraft Traffic x Residential Distance and Blood Lead Levels in Toddlers

Predicted BLL (µ/dL)

Piston-Engine Aircraft Traffic at RHV (centered)

- < 0.5 Miles
- 0.5 to 1.5 Miles
Cumulative Impact of AvGas in Toddlers (μg/dL)

- Typical Child: 1.8
- <0.5m: 2.5
- <0.5m + Max Traffic: 3.3
- <0.5m + Max Traffic + East: 3.5
- <0.5m + Max Traffic + East + <10% SES: 3.7
Percent of Toddlers with Blood Lead Level >4.5 µg/dL

- Typical Child: 1.8%
- <0.5m: 2.6%
- <0.5m + Max Traffic: 3.4%
- <0.5m + Max Traffic + East: 6.3%
- <0.5m + Max Traffic + East + <10% SES: 8.9%
Percent of Toddlers with Blood Lead Level >3.5 μg/dL

- Typical Child: 1.8%
- <0.5m: 2.5%
- <0.5m + Max Traffic: 7.0%
- <0.5m + Max Traffic + East: 10.5%
- <0.5m + Max Traffic + East + <10% SES: 13.9%
IQ Scores for Tibial Bone Lead AND Mean Lifetime Blood Lead Levels

IQ Scores for Tibial Bone Lead OR Mean Lifetime Blood Lead Levels

- p < 0.01
- p = NS
Lead Particles in Aircraft Emissions and Paint

Lead Particles in aircraft exhaust
20 nm

Lead in paint pigment
500 nm

NASEM 2021
Risk Factors for Chronic Heart Disease

- Sex
- Obesity
- Smoking
- Diabetes
- Salt Intake
- Toxic Metals
- Physical Activity
- Air Particles (PM2.5)
- Genetic Susceptibility
Lead is a Risk Factor for Coronary Heart Disease
Crisis /ˈkrisiːs/

a time of intense difficulty, trouble, or danger

a time when a difficult or important decision must be made
Air Lead vs Blood Lead

Lead Reduces Neurite Length in Dopaminergic Neurons

The lowest concentration of lead acetate used (0.001 μM) caused a significant decrease in neurite length that was exacerbated by incubation in higher concentrations of lead (0.01 and 0.10 μM).
Toxic Metals and CVD Mortality

- **Exposure**: Arsenic, Lead, Cadmium
- **Outcome**: CVD, CHD, Stroke
- **Relative risk (95% CI)**: Top v bottom third of baseline level

Exposure is associated with an increased risk of coronary heart disease (CHD) and overall cardiovascular disease (CVD). A linear dose-response association was also observed.