Health and economic impacts of lead

World Health Organization

Global Alliance to Eliminate Lead Paint

Outline

- Background
- Sources and routes of exposure
- Health effects
- Societal and economic impacts

Background

- Lead is a versatile and widely used toxic substance
- Human activities result in environmental contamination:
  - mining & smelting; manufacturing, use, recycling and disposal of products made with lead
- Can be used in the manufacture of paint to give properties e.g. colour, rapid drying, corrosion resistance
- Lead paint is a source of human exposure to lead

Exposure to lead from paint can occur through its lifecycle

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- Manufacture - lead pigments and driers:
  - Inhalation and ingestion exposure to raw materials during mixing
  - Environmental contamination from spills, unsafe waste disposal

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- Use - application:
  - Inhalation of paint aerosols

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Exposure to lead from paint can occur through its lifecycle

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- Use – ageing paint:
  - Paint fragments into flakes and dust that contaminate the environment (indoor and outdoor)
  - Dust also produced when painted surfaces rub together e.g. window frames
  - Children may ingest flakes and dust
- Removal:
  - Use of abrasive methods and burning produces large amount of lead dust and fumes

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Lead is a multi-system toxicant

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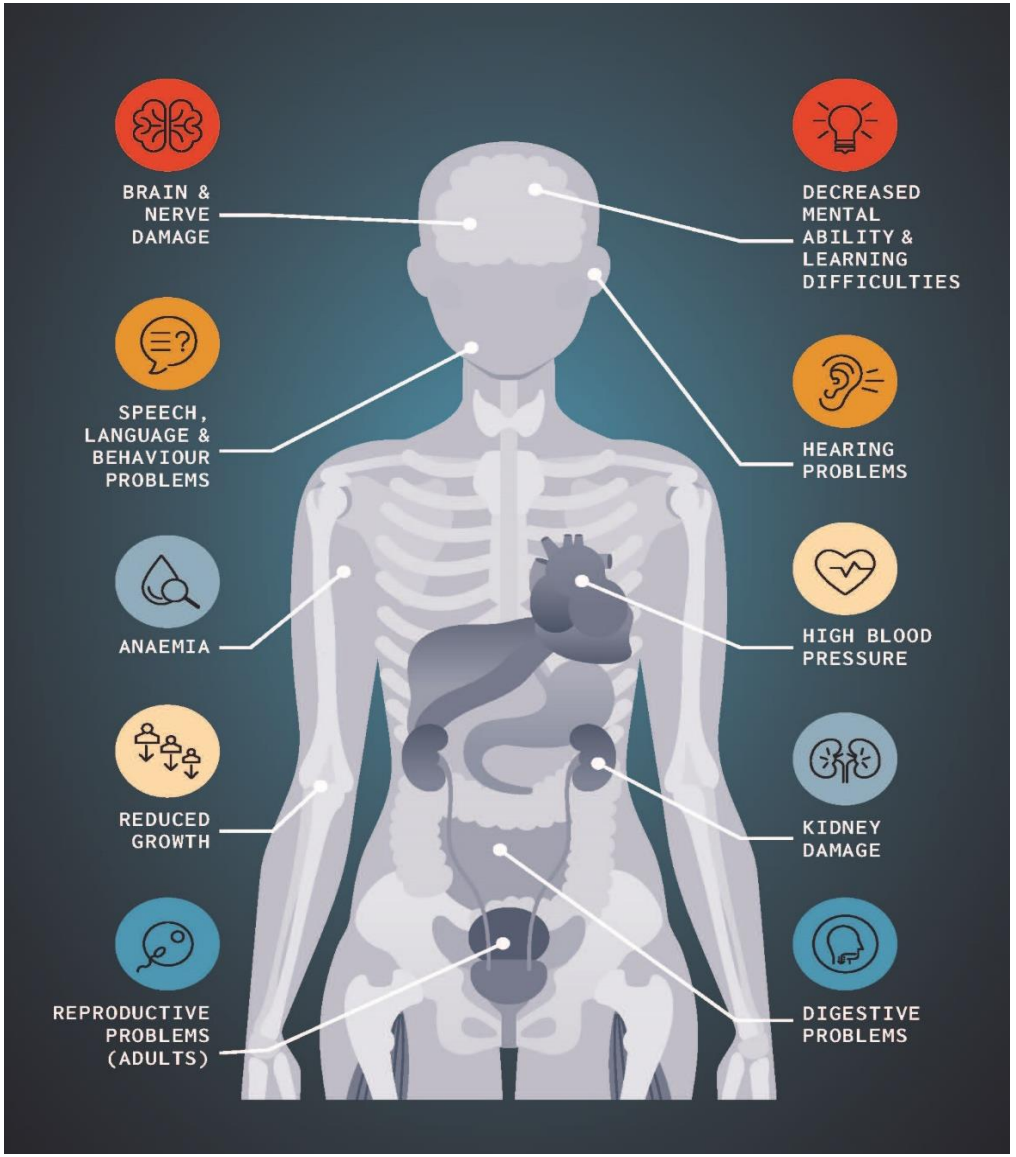
- Main routes of exposure are ingestion and inhalation
- No known level of exposure without harmful effects
- Mechanism of toxicity is complex
- Accumulates in bone and remobilized during pregnancy, lactation and menopause



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Features of lead exposure may be non-specific

- Low-level exposure – sub-clinical effects e.g. reduced IQ, antisocial behavior, increased risk of hypertension, myocardial ischaemia & renal disease
- Higher-level exposure – more overt poisoning, e.g. anorexia, abdominal colic, constipation, fatigue, mood changes, insomnia, anaemia
- Severe poisoning – developmental regression in young children, convulsions, cerebral oedema, death

Children are especially vulnerable

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- Greater exposure:
  - spend more time on the ground and in contact with contaminated soil and dust
  - hand-to-mouth activity, mouthing
  - absorb 4–5 times more lead from the gut than adults
- Early childhood is critical period for neurological and organ development
- Damage may be life-long
  - reduced potential for intellectual development
  - increased likelihood of behavioural disorders

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Children can be poisoned by lead paint

- Case report – ingestion of paint flakes (1)
- 2 year old boy with irritability, abdominal pain, anaemia
- Blood lead concentration was 64 µg/dL
  - ➢ threshold for chelation is 45 µg/dL
- Abdominal x-ray showed paint flakes distributed through large intestine

Figure 2 – A large quantity of lead paint chips can be seen in this radiograph of the abdomen and pelvis of a 2-year-old boy with lead poisoning.

Daubert GP. Lead poisoning in a young boy. Consultant for Pediatricians. 2006; 5(3):147-149.

Children can be poisoned by lead paint

- Case report – ingestion of paint flakes (2)
- Treatment given:
  - Whole-bowel irrigation to wash out gut
  - 4 rounds of oral and i.v. chelation therapy over 7 months with repeated hospital admissions
- Concentration of lead in paint not measured

Pregnant women are vulnerable

- Pregnancy mobilizes lead stored in bone, releasing it back into blood where it can be circulated to maternal tissues and the fetus
- Lead exposure may cause reduced fetal growth
- Lead exposure in pregnancy increases risk of complications e.g. hypertension

Lead causes significant burden of disease

Estimates from Institute for Health Metrics and Evaluation (IHME), 2017 data

- 1.06 million deaths from long-term effects
- 24.4 million disability adjusted life years (DALYs) lost
- 63.2% of the global burden of idiopathic developmental intellectual disability
- 10.3% of hypertensive disease
- 3.6% of chronic kidney disease

https://vizhub.healthdata.org/gbd-compare/

Small IQ reduction has significant societal impact

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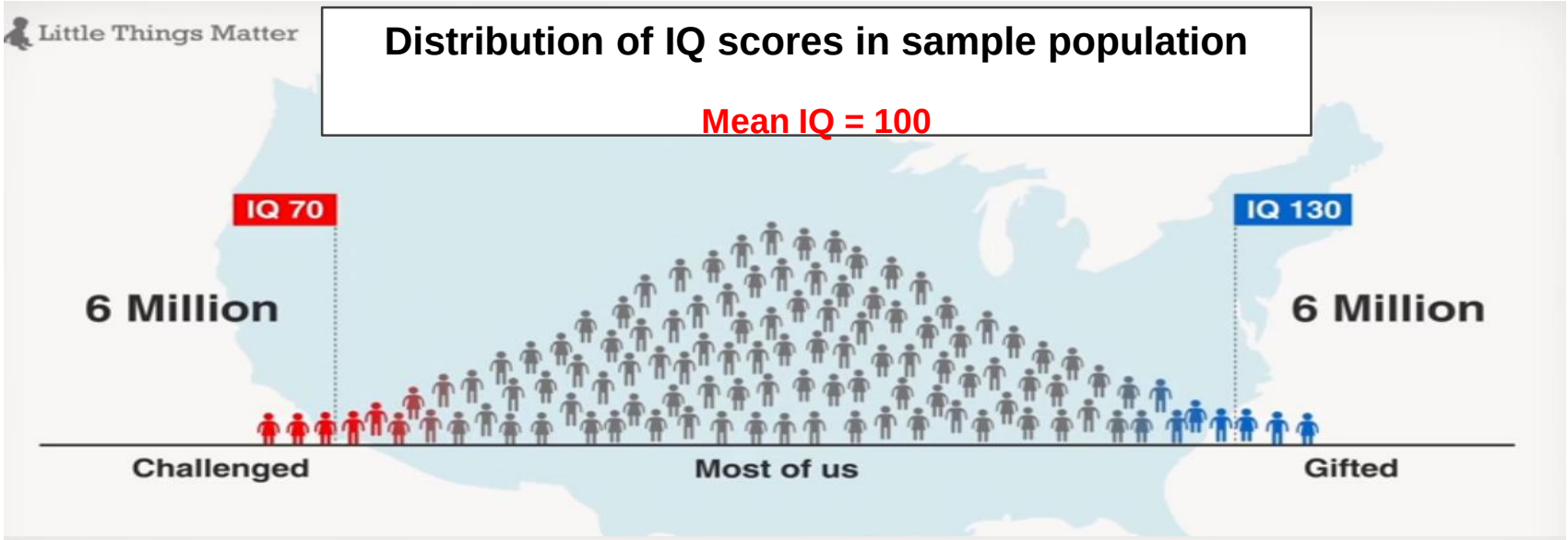

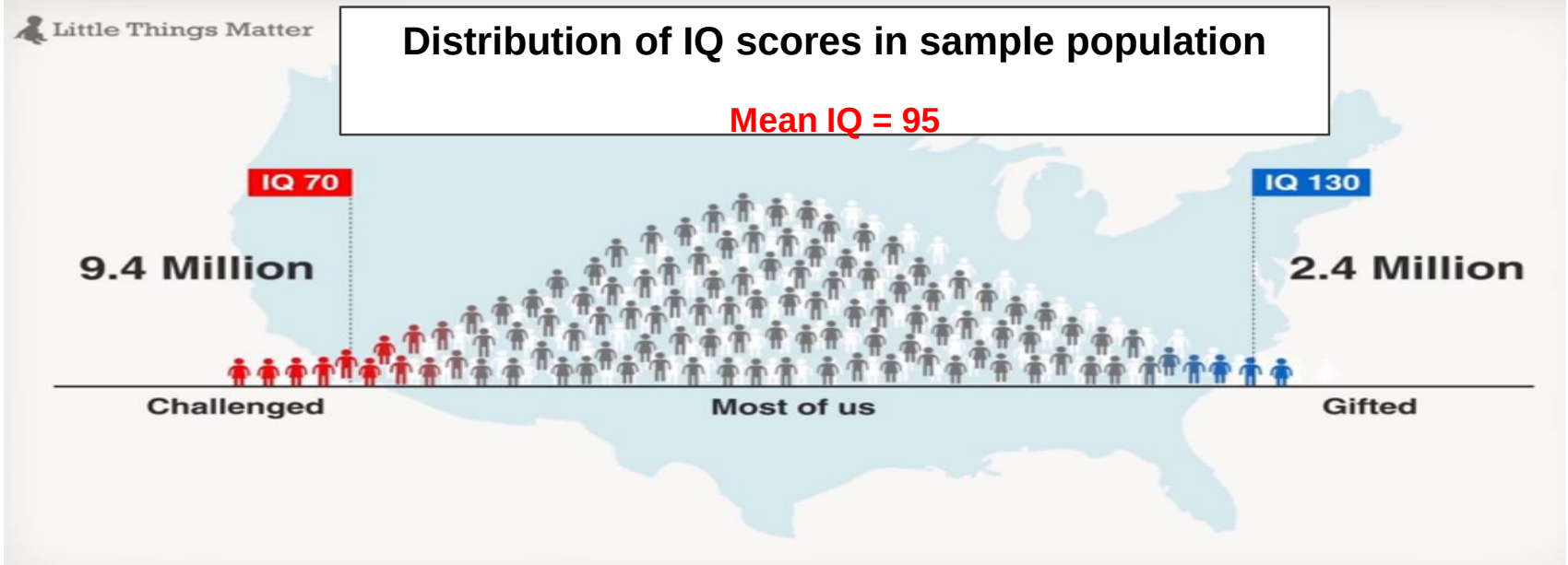

Economic costs of lead exposure are high

- Estimated global economic losses due to reduced IQ is US$ 977 billion, i.e. ~1.2% of global GDP
- Largest economic burden is borne by low and middle income countries
- Estimated loss to China is 2% of GDP

- *Attina TM, Trasande L. Economic costs of childhood lead exposure in low- and middle-income countries. Environ Health Perspect. 2013 Sep;121(9):1097-102*

- https://med.nyu.edu/departments-institutes/pediatrics/divisions/environmental-pediatrics/research/policy-initiatives/economic-costs-childhood-lead-exposure-low-middle-income-countries

Economic benefits of action are significant

- Banning lead paint now saves having to pay future costs
  - Avoids future costs of lead exposure resulting from use of lead paint now e.g. cost of reduced IQ, cost of criminality
  - Avoids future costs of hazard controls for legacy paint e.g. remediation
    - estimated costs of remediating lead-painted homes:

      France: US$ 194 – 499 million

      USA: US$ 1 – 11 billion

- *Pichery C et al. Childhood lead exposure in France: benefit estimation and partial cost-benefit analysis of lead hazard control. Environmental Health. 2011;10:44*
- *Gould E. Childhood Lead Poisoning: Conservative Estimates of the Social and Economic Benefits of Lead Hazard Control. Environ Health Perspect, 2009;117: 1162-1167*

Conclusions

- Lead has wide-ranging effects on health – these have personal, societal and economic impacts
- Lead is a persistent hazard – it remains in the environment, in the home and in the human body
- Lead paint is an important source of exposure to lead
- Prevention - through banning lead paint - is better (and cheaper) than having to deal with the consequences of lead paint later on