Health, economic and environmental impacts of lead
Outline

• Background
• Sources and routes of exposure
• Health effects
• Societal and economic impacts
• Environmental 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
Lead persists in the environment

• Lead can be released during paint manufacture, application and removal

• Old lead paint fragments into flakes and dust that contaminate the environment

• Lead can remain in the environment indefinitely

• Lead paint creates legacy of potential human exposure for years into the future
Lead is a multi-system toxicant

- Inhalation and ingestion are main routes of exposure
- No known level of exposure without harmful effects
- Accumulates in bone
- Affects multiple body systems
- Long-term effects include reduced IQ, cardiovascular & renal disease
Children are especially vulnerable

• 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 permanent
  ➢ reduced potential for intellectual development
  ➢ increased likelihood of behavioural disorders
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
- Increased risk of hypertension during pregnancy
- Lead exposure of pregnant women results in exposure of the fetus – may cause reduced fetal growth
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

• https://vizhub.healthdata.org/gbd-compare/
Small IQ reduction has significant societal impact

Mean IQ = 100
Mean IQ = 95
Economic costs of lead exposure are high

• Estimated economic losses due to reduced IQ is ~1.2% of global GDP
  ➢ Largest economic burden is borne by low and middle income countries

• Banning lead paint now saves future costs
  ➢ Avoids future costs of lead exposure when lead paint used now e.g. cost of reduced IQ, cost of criminality
  ➢ Avoids future costs of hazard controls for legacy paint e.g. remediation
    o estimated costs of remediating lead-painted homes:
      - France: US$ 194 – 499 million
      - USA: US$ 1 – 11 billion
Lead is toxic to organisms at all levels

• Harmful to marine and terrestrial ecosystems and organisms

• Plants absorb lead from the soil and retain it in their roots
  ➢ inhibits plant growth
  ➢ may be a source of dietary exposure

• Toxic to soil microorganisms and to invertebrates e.g. nematodes, insects
Lead is toxic to organisms at all levels

• In higher animals, damages multiple organ systems

• Causes growth deformities e.g. spinal deformities in fish and birds

• Secondary poisoning may occur e.g. in predators feeding on contaminated animals

• Bioaccumulates in organisms but does not biomagnify
Conclusions

• Lead is a persistent hazard – it remains in the environment, in the home and in the human body

• Lead has wide-ranging effects on health – these have personal, societal and economic impacts

• Lead paint is an important source of exposure to lead

• Prevention through banning lead paint is better (and cheaper) than cure!