Heavy metal exposures – providing GPs with evidence to assist in patient care

Lead paint - Ipswich, Queensland

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Take home message:

There is no safe level for a range of neurotoxic metals

Prevailing view

- Metal exposures are no longer a major public health concern in 21st century Australia

What the evidence shows

- Many situations and locations where exposure still occurs and poses risk to human health
- Environmental sources include paint, soil, dust, mining & smelting
- GPs are uniquely positioned to advise/assist

Why are metals a potential problem?

- Environmental metals and metalloids easily absorbed into the human body.
- Exposure occurs in 3 main ways:
  - Consumption of produce grown in contaminated soil
  - Ingestion of soil, dust, paint
  - Inhalation of soil and dust
- Young children most at risk - higher absorption; more hand - mouth activity.
- Can cause adverse neurocognitive and behavioural outcomes.

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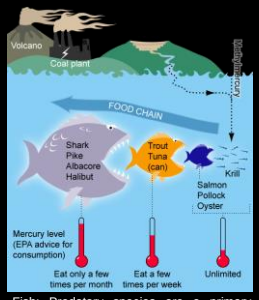
Typical Mercury Exposures

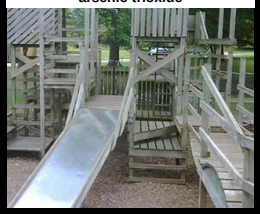


Fish: Predatory species are a primary source of Hg exposure (methylmercury)

http://www.betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/pages/Mercury_in_fish

Typical Arsenic Exposures

Arsenic timber treatments: copper chrome arsenate (CCA) and arsenic trioxide



2006 - use of CCA banned where people might come into frequent contact with the treated timber:

Garden furniture, picnic tables, exterior seating, children's play equipment, patio and domestic decking, and handrails.

http://apvma.gov.au/node/12366

Sources of lead and other metals

Myth

Low blood levels are not a concern and probably not harmful

Reality

Significant damage occurs at very low levels

Reality

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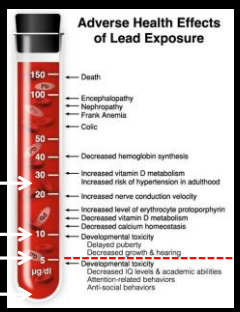
Higher exposures cause damage but are proportionally less than low exposures

Spectrum of environmental lead and human health effects



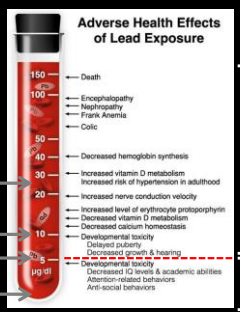
Australian 1983 level

Australian 1993 level

Australian 2015 level

Pre-industrial humans (0.016 µg/dl)

Spectrum of environmental lead and human health effects



Australian 1983 level

Australian 1993 level

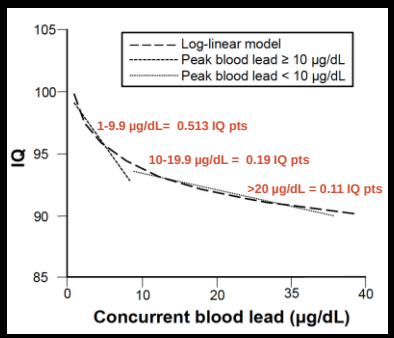
Australian 2015 level

Pre-industrial humans (0.016 µg/dl)

Greatest individual effect but smaller number of children affected (100,000)

Greatest loss of IQ points across total popn of children < 5 yrs (1.3 million)

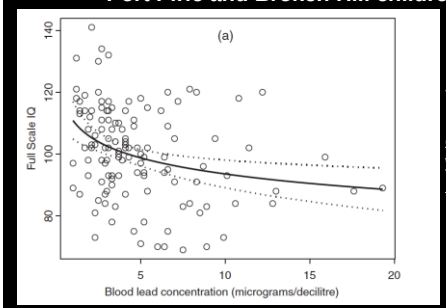
No Threshold for Low-Level Lead Toxicity



Lanphear BP, et al. Environ Health Perspect 2005;113:894-899.

Regression of WISC-IV Full Scale IQ on blood lead concentration level (log PbB)

Port Pirie and Broken Hill children



Blood lead from 1 to 10 µg/dl **associated with a loss 13 IQ points**

Earl et al. 2015. Aust. J Psychology doi: 10.1111/ajpy.12096

Myth:

NHMRC blood lead guidelines reflect international epidemiological evidence

Reality:

Only partly aligned with current evidence and underplay real risks to the community

NHMRC 2015 – Blood Lead

Australian Government
National Health and Medical Research Council

NHMRC STATEMENT: EVIDENCE ON THE EFFECTS OF LEAD ON HUMAN HEALTH

- Blood lead levels >10 µg/dL - harmful effects on organs and bodily functions.

BUT

- Evidence for health effects occurring as a result of blood lead levels less than 10 µg/dL (100 ppb) is less clear.
- Blood lead levels <10 µg/dL associated with reduced childhood IQ, academic achievement and behavioural issues.

Globally - Clear consensus that there is no safe level

- WHO
- German Biomonitoring Commission
- US Centers of Disease Control
- US EPA
- Health Canada

Summary of Effects less than 5 µg/dL

US National Toxicology Program 2012

Health effects of low-level lead concentrations in children

The level of evidence linking various health effects in children

Lead concentration level in blood	Level of evidence	Health effects
< 5 micrograms per decilitre	Sufficient	• Decreased academic achievement • Lower IQ scores • Attention-related behaviours • Anti-social behaviours
	Limited	• Delayed puberty • Decreased kidney function in children ≥ 12 years

Source: www.ntp.niehs.nih.gov/go/36443

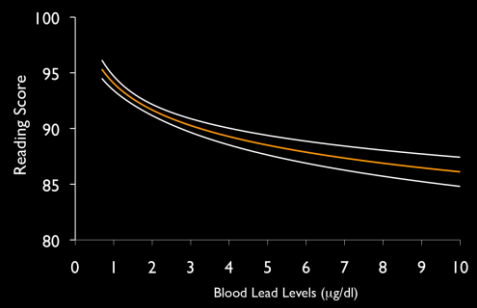
Myth:

Blood lead exposure has limited human health effects

Reality

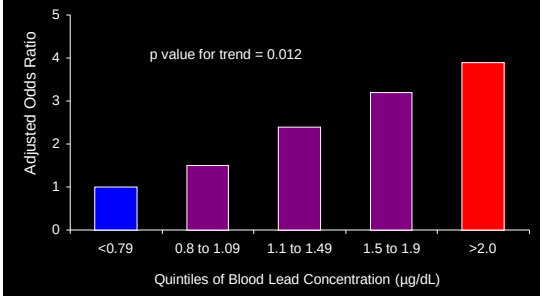
Blood lead associated with decreased education scores, adverse behavioural outcomes and increased mal-behaviours

Reading scores by blood lead levels in US children, NHANES III, 1998-1994



Adapted from Lanphear et al. 2000. Public Health Reports, 115, 521-529.

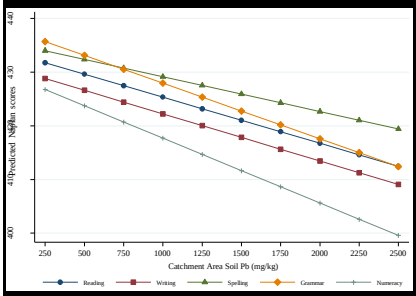
Risk of ADHD by Blood Lead Levels in US Children, 4 to 15 years, NHANES 1999-2002



Braun J, et al. EHP 2006;17:500-505.

Effects of exposure on Broken Hill school scores Years 3 and 5

Predicted (adjusted for SES) NAPLAN school scores versus soil Pb

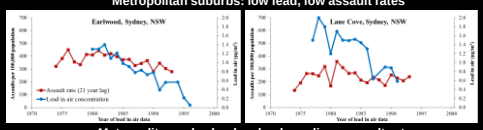


Predicted NAPLAN scores for children in high lead areas 14 % lower

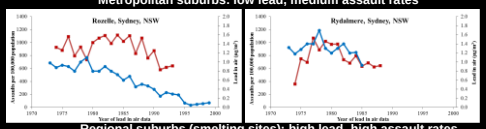
Dong, Taylor et al. 2015. Environmental Pollution.

Air lead vs assault rates for six NSW suburbs '1973–'99

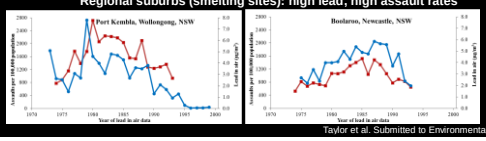
Metropolitan suburbs: low lead, low assault rates



Metropolitan suburbs: low lead, medium assault rates



Regional suburbs (smelting sites): high lead, high assault rates



Taylor et al. Submitted to Environmental Health

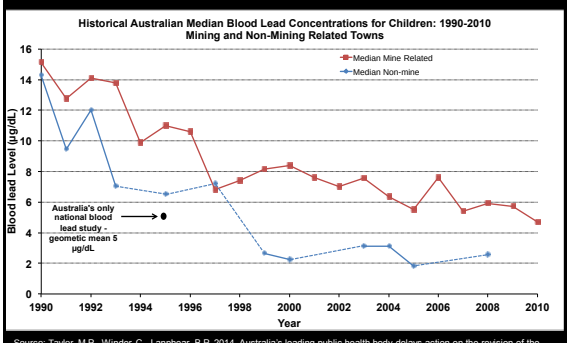
Myth

Lead and metal exposure and environmental contamination is only relevant to industrial workers and those that live near smelters

Reality

Exposure risk issue is relevant to many groups, especially inner city residents, young children, renovators

Falling Australian blood lead exposures



Source: Taylor, M.P., Winder, C., Lanphear, B.P. 2014. Australia's leading public health body delays action on the revision of the public health goal for blood lead exposures. *Environment International*, 70, 113–117.

A contemporary driver – DIY home renovations

The Telegraph http://www.telegraph.co.uk/

Doing DIY in period homes can put pregnant women at risk

Doing DIY in period homes can harm unborn children by putting women at risk of lead poisoning, researchers warn.

Exposures sources

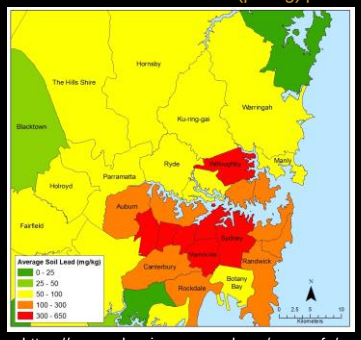
Soil

Dust

Paint

VegeSafe Results - Sydney

Maximum soil Pb concentration (pm/kg) per house



https://research.science.mq.edu.au/vegesafe/

Blood lead measures on Australian city children

- Fremantle 2005 study – 8% (8/100) > 5 µg/dL
- Sydney 2006 study - 7.5% (8/107) > 10 µg/dL
- Overall estimate - 100,000 (7.4%) children > 5 µg/dL

The problem is much improved, but has not 'gone away'

Western Australian locations of concern

Northampton – elevated soil lead in from mining and smelting operations

Kwinana Bulk Terminal – multiple petrol refineries

Fremantle – legacy exposures from former lead smelter

Esperance 2007 – ~21 % of children ≥ 5 µg/dL

Figure 1. Location of Esperance, Western Australia. The Pb carbonate concentrate is transported by road (blue line) and rail (hatched line) from the Magellan mine to Esperance.

Myth

There's nothing we can do about it

Reality

Many practical and simple steps can be taken to reduce dust and risk of metal exposure

Breast Feeding and Exposures

Contaminants predominantly **lower** in natural breast milk than:

- Formulas
- Cow's milk

Avoidable contamination can occur from:

- Mother eating fish
- Lead/copper contaminated tap water used to make formula

Breast is best (as we know)

Breast milk is the optimal nutrition for the young infant.

Provides the best protection from environmental contamination.

Maternal and environmental conditions can influence milk metal levels.

Protection in the home – ways to reduce exposure

- If pregnant eat fish with low levels of mercury
- Test soils, household dusts and paint
- Remove flaking paint (use a specialised professional)
- Move out during renovation
- Regular actions
  - Wash hands
  - Wet wipe surfaces
  - Reduce dust
  - Use a HEPA vacuum cleaner.

Conclusion: A Little is Still Too Much

Recommended 7 min video

http://youtu.be/E6KoMAbz1Bw

Links

- Get the house tested - use a NATA accredited service: www.nata.com.au
- Test dusts – on surfaces, ceilings, vacuum bag.
- Soil screening: VegeSafe - http://research.science.mq.edu.au/vegesafe/
- Specialised professional painters: www.painters.edu.au
- Links to reliable sources of information:
  - www.cdc.gov/nceh/lead
  - www2.epa.gov/lead
  - http://www.nhmrc.gov.au/health-topics/lead-blood-levels
  - www.leadsafeworld.com/solutions
- Link to easy to read articles:
  - https://theconversation.com/profiles/mark-patrick-taylor-11394/articles
  - More detailed articles (free to access) – Environmental Health Perspectives.

ABC coverage of lead and its risks

Catalyst, 2015. Lead Astray. http://www.abc.net.au/catalyst/stories/4174798.htm

Gardening Australia, 2015. Safe Soil, Gardening Australia, ABC, 14th March 2015, http://www.abc.net.au/gardening/stories/s4197011.htm