

Low-level Lead Toxicity

The Ongoing Search for a Threshold

Bruce Lanphear, MD, MPH
Simon Fraser University
Vancouver, British Columbia

Collaborative on Health and
Environment



The Lead Pandemic

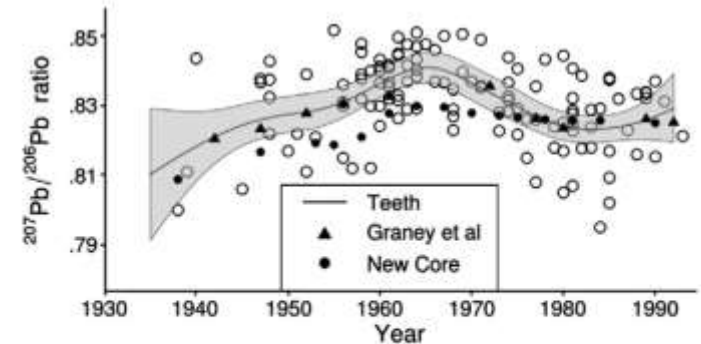
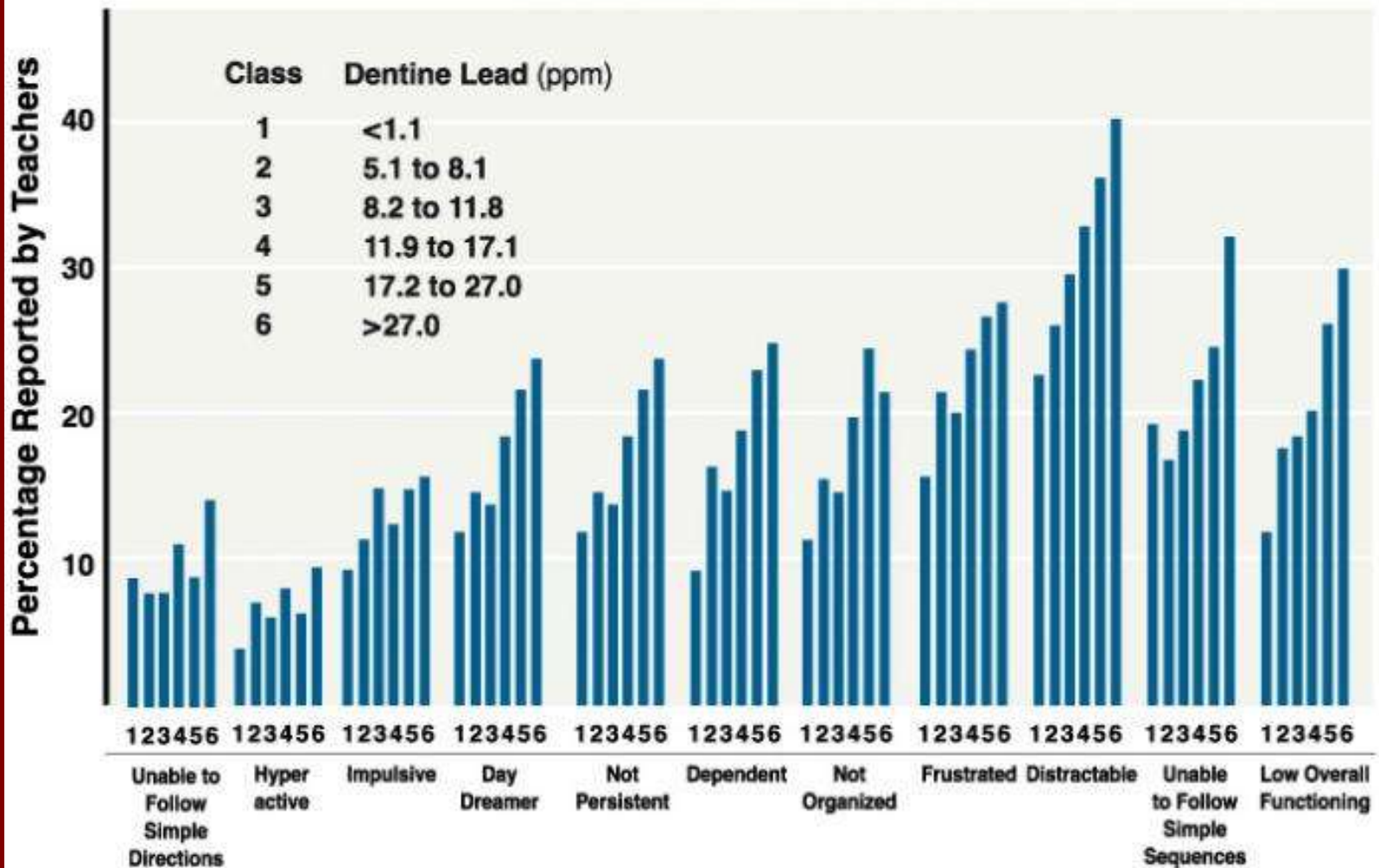
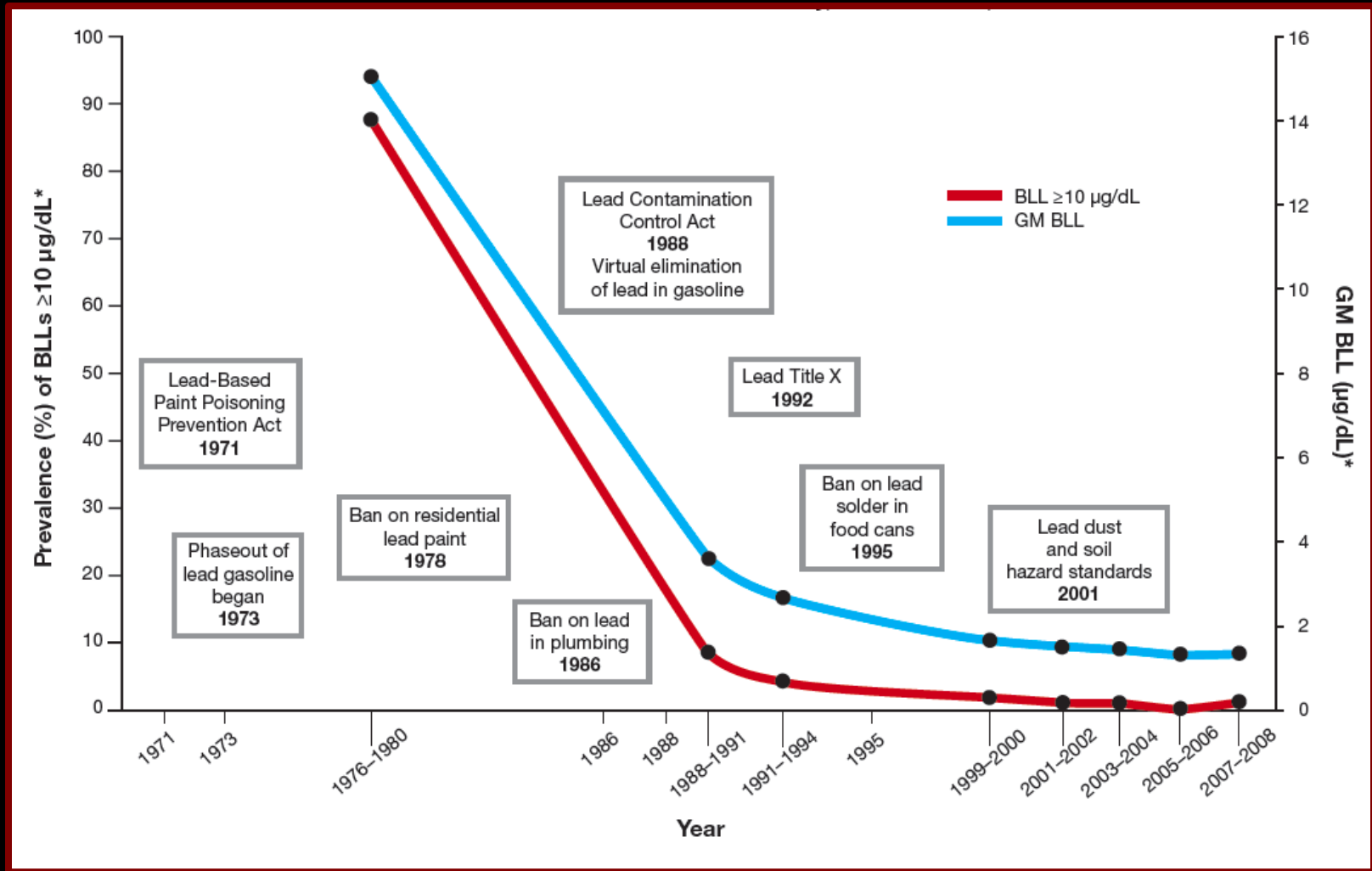


Fig. 4. $^{207}\text{Pb}/^{206}\text{Pb}$ isotope ratios in teeth and lake sediments during the course of leaded gasoline introduction, peak, and phase-out. The line and shaded area for tooth isotope ratios is the smoothed average \pm one standard error, and the open circles are individual tooth data points. The error bars on the individual lake sediment data points (not shown) were approximately the same size as the symbols.

Behavioral and Emotional Problems of Lead Exposure

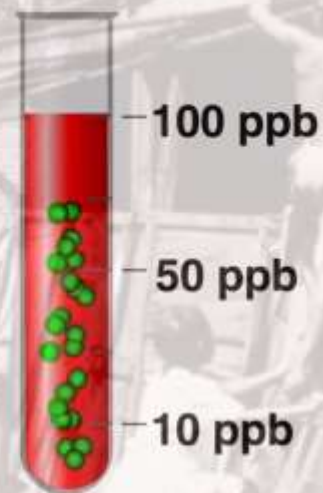



Public Health Regulation and Children's Blood Lead Levels, United States, 1970-2010



Adapted from CDC. MMWR. 2012;61
(Supplement)

IQ095

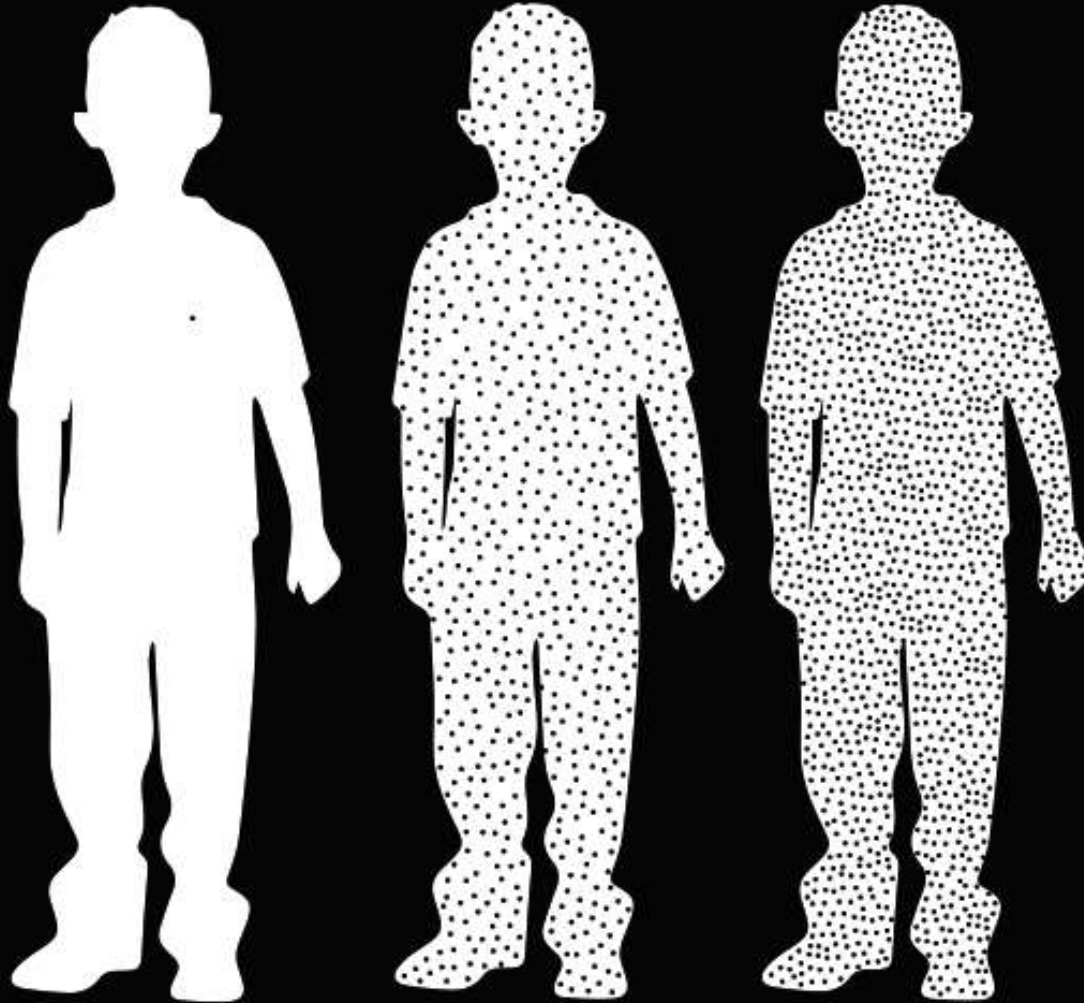


 OP Pesticides



No Acceptable Level?

Body Burden of Lead in Ancient Child, Typical Child (circa 1960) and Lead Poisoned Child

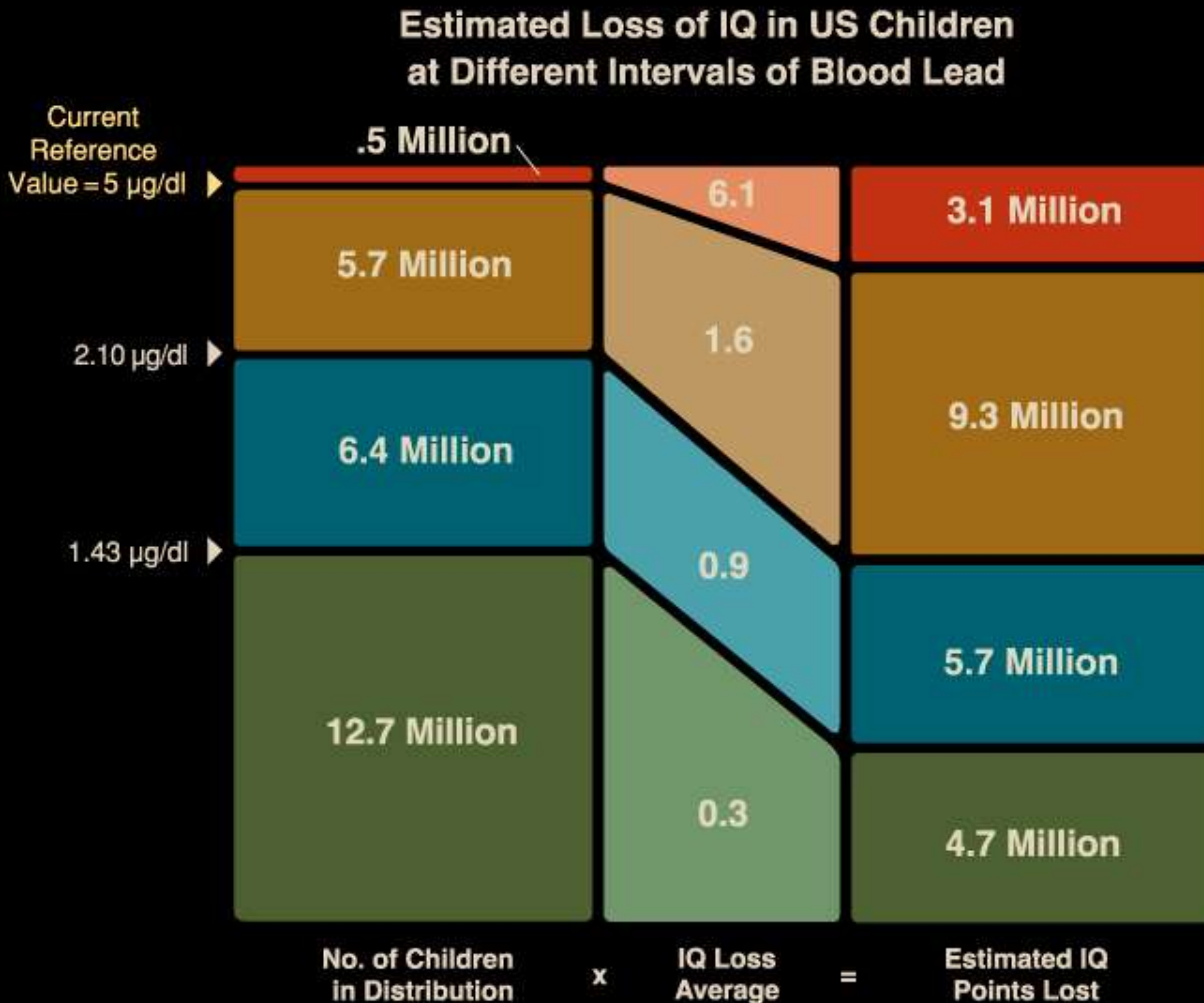


Adapted from Patterson et al (adapted from NRC Report).

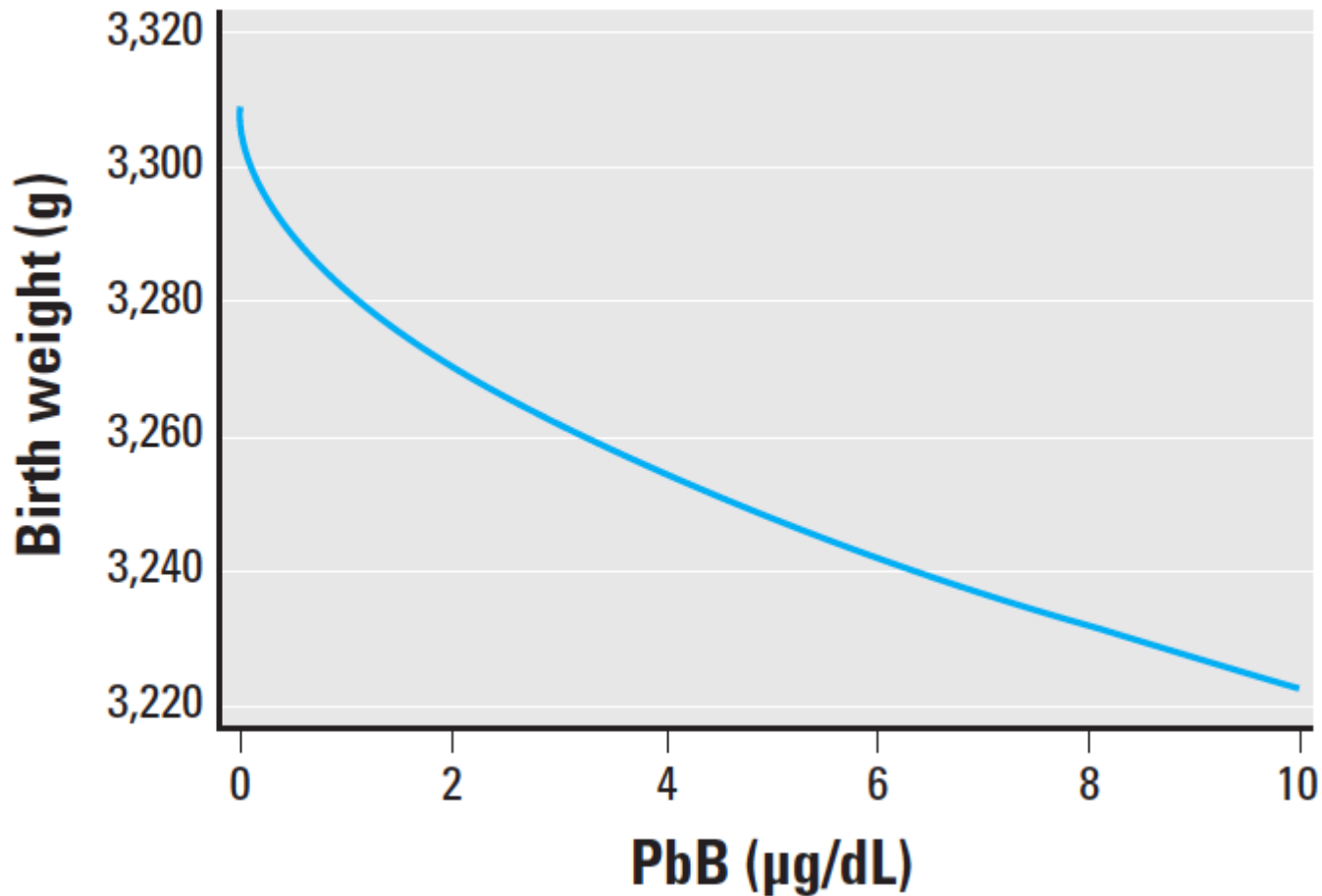
The Prevention Paradox

The majority of disease and disability occurs in people who are at low to moderate risk

The Prevention Paradox



Dose Response Relationship of Maternal Blood Lead and Birthweight



Impact of Lead on PTB

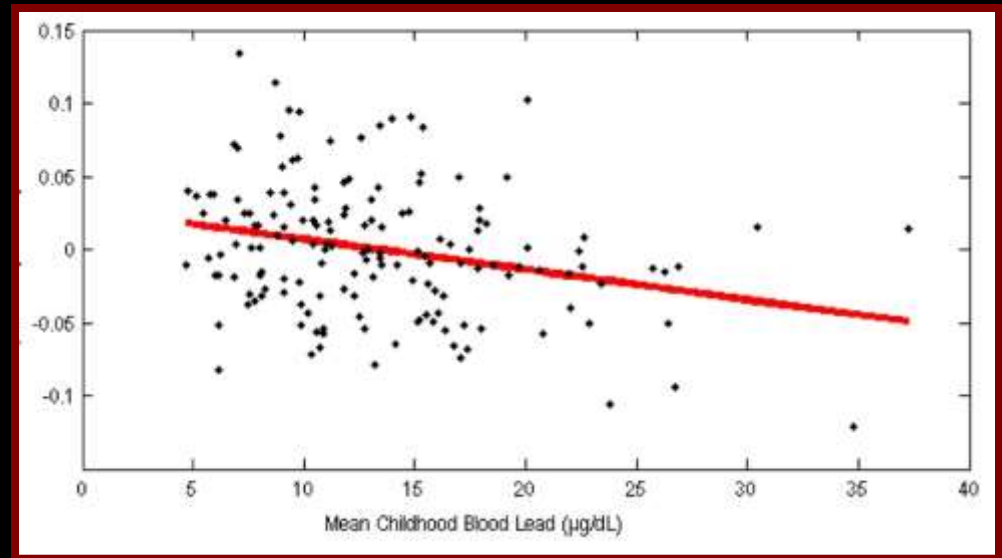
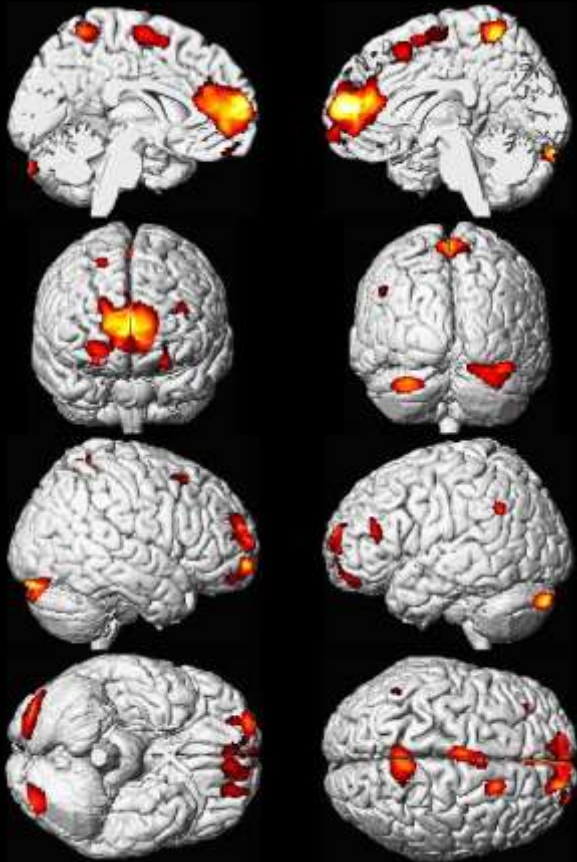
OR=1.9



The background of the slide is a dark red color with a prominent, irregular pattern of black cracks, resembling cracked earth or dried mud. The cracks vary in thickness and direction, creating a complex, textured appearance.

Low-Level Lead Toxicity and Psychopathology

Gray Matter Loss by Childhood Lead Exposure

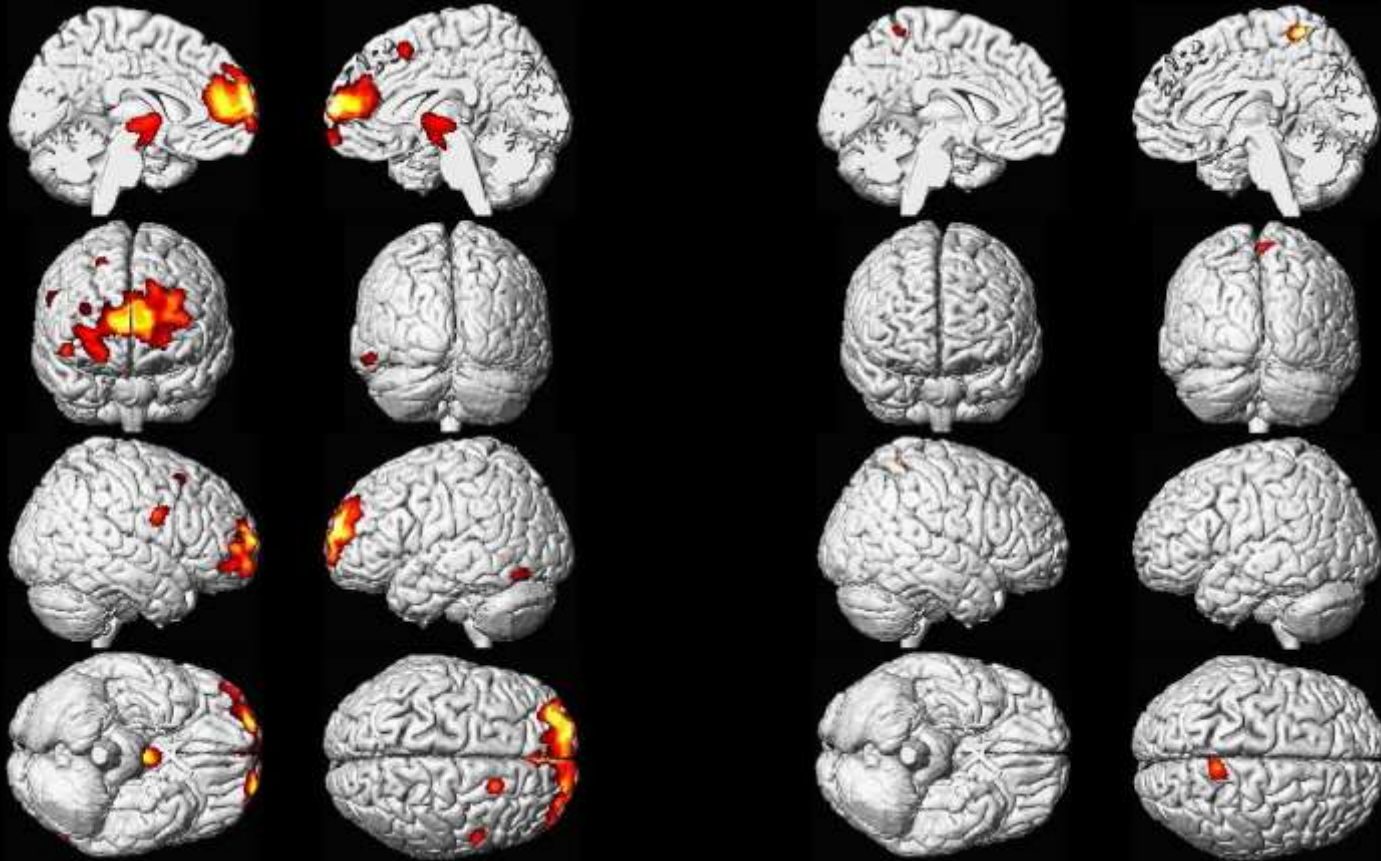


Adjusted for child's age, birth weight. Sex, gestational age, IQ, prenatal tobacco, prenatal alcohol, prenatal marijuana, total intracranial volume, SES and HOME Inventory did not alter results (Cecil K, PLoS Medicine, et al. 2008).

Reduction in Gray Matter by Childhood Blood Lead Levels and Subject's Sex

Men (n=83)

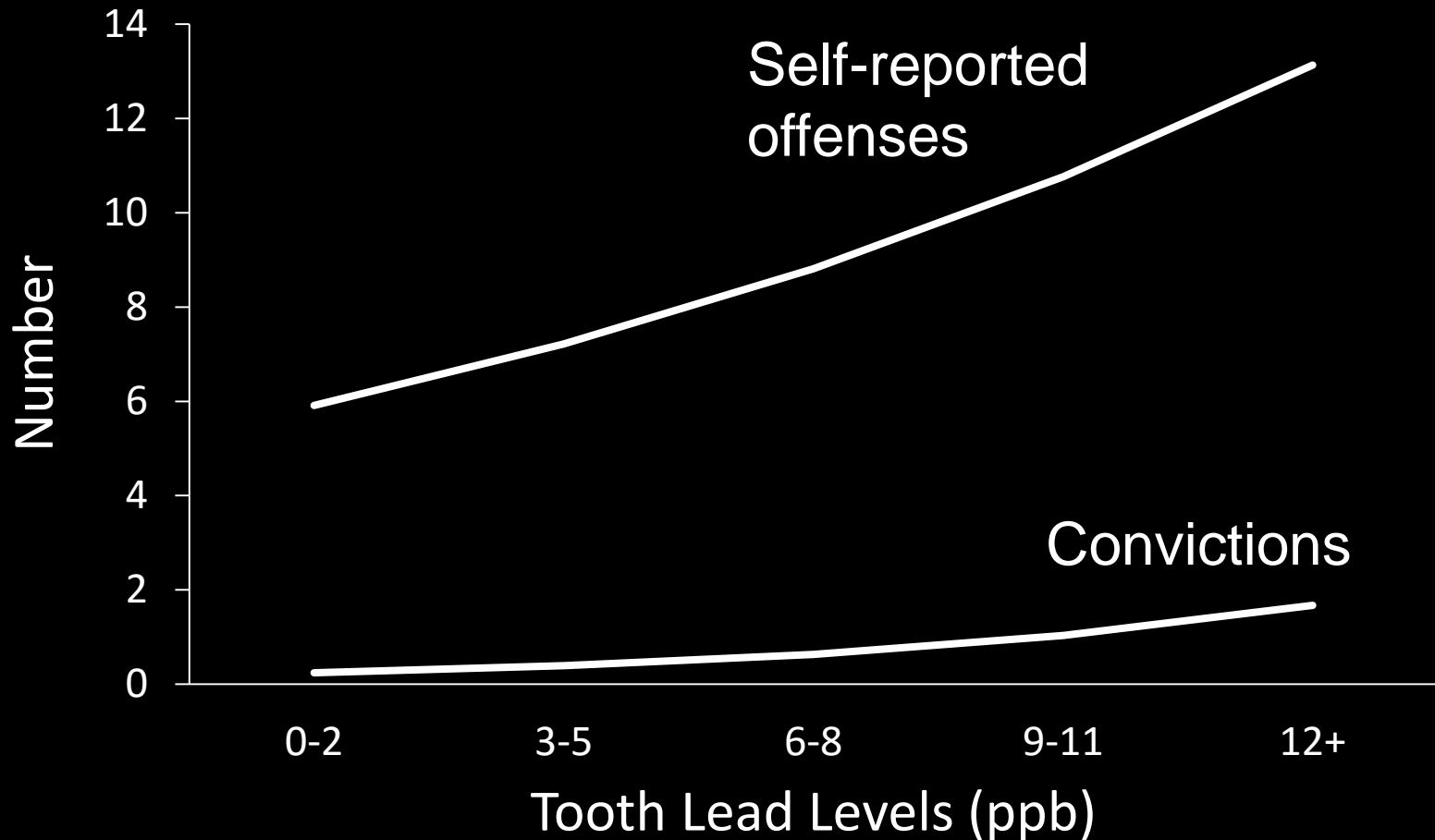
Women (n=74)



18% of ADHD

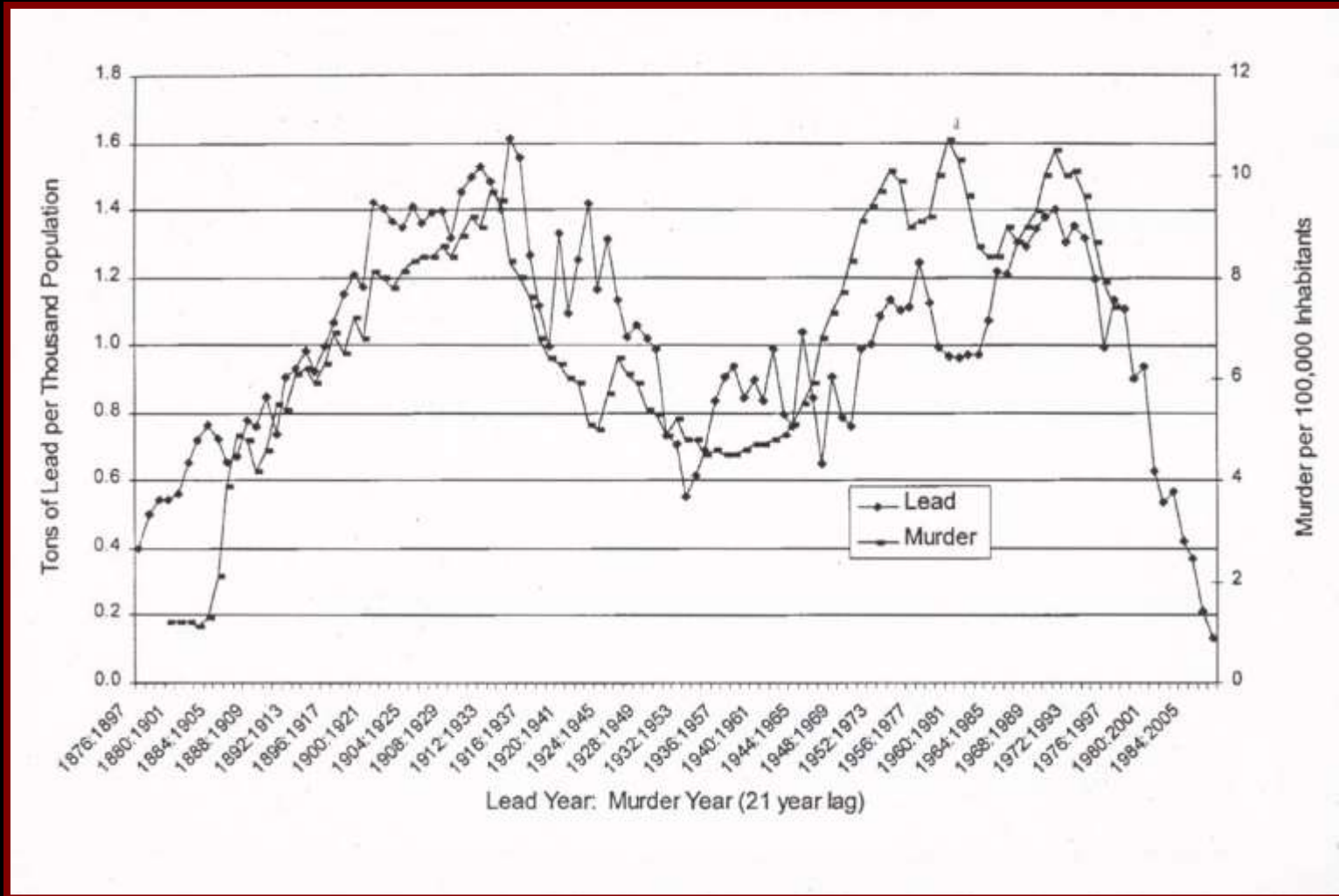
Froehlich T, et al. Pediatrics 2009;124:e1054-1063.

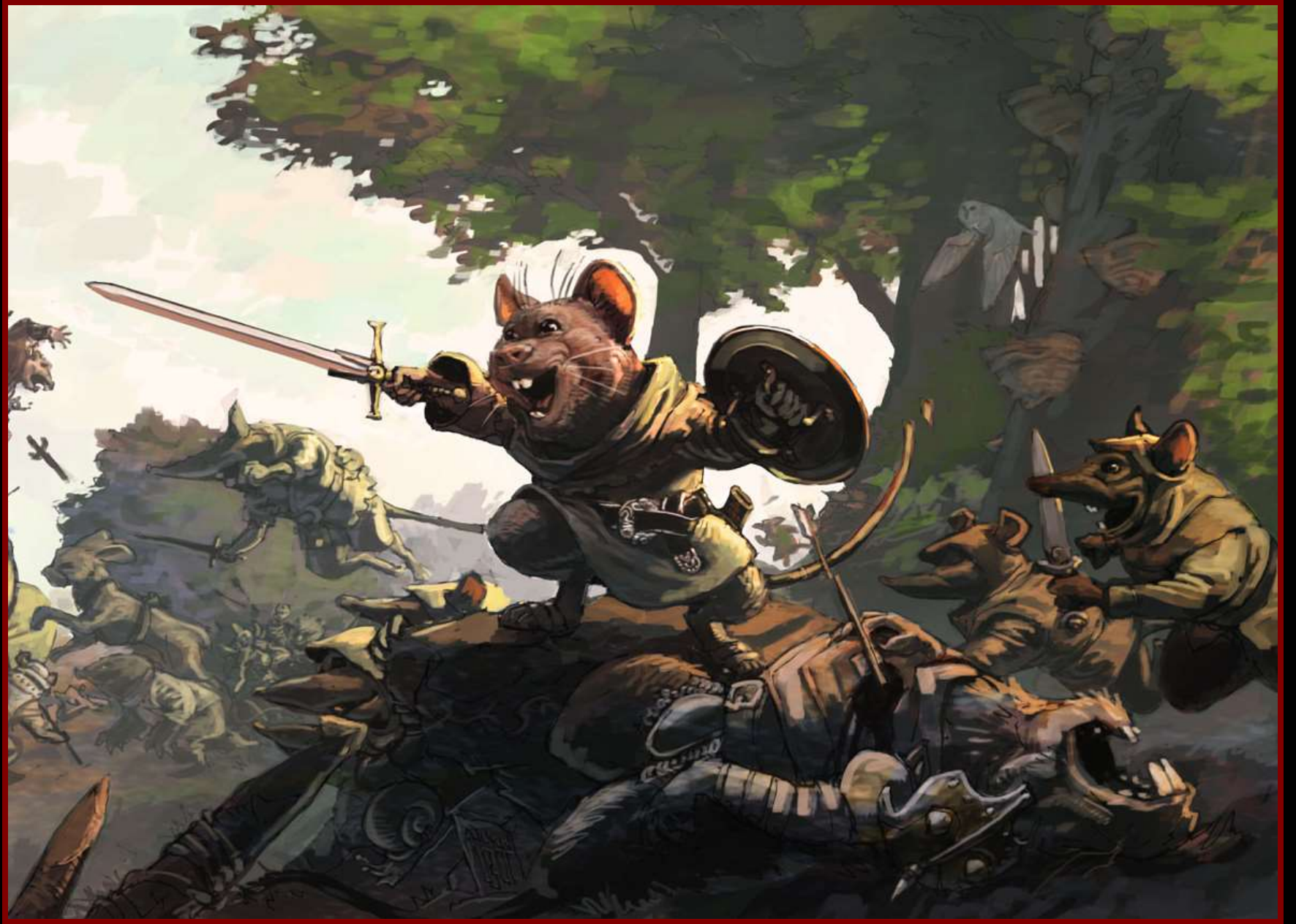
Tooth Lead Levels and Criminality

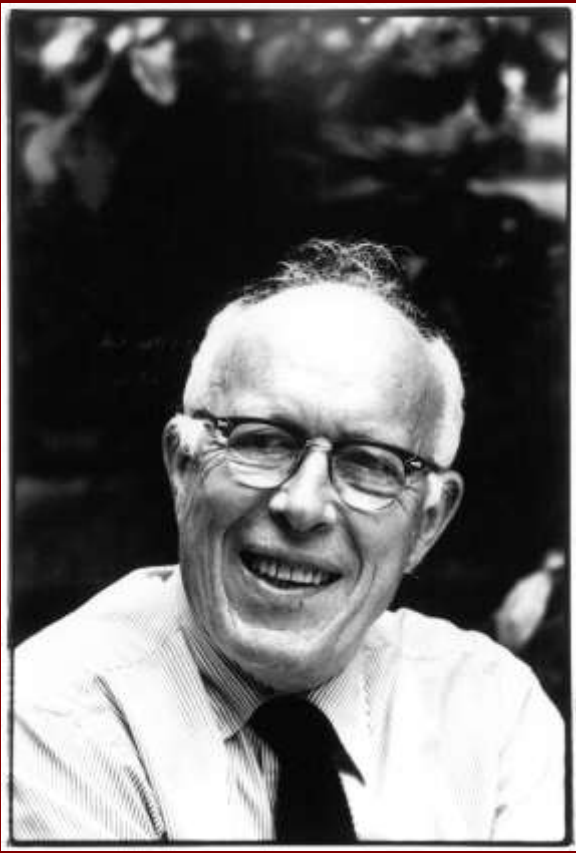


Fergusson D, et al. J Epidemiol Community Health 2008;62:1045-1050. Adjusted for SES, maternal education, ethnicity, family conflict, maltreatment, maternal smoking during pregnancy, parental criminal offending and parental alcoholism.

Lead Exposure and Homicides in the U.S.



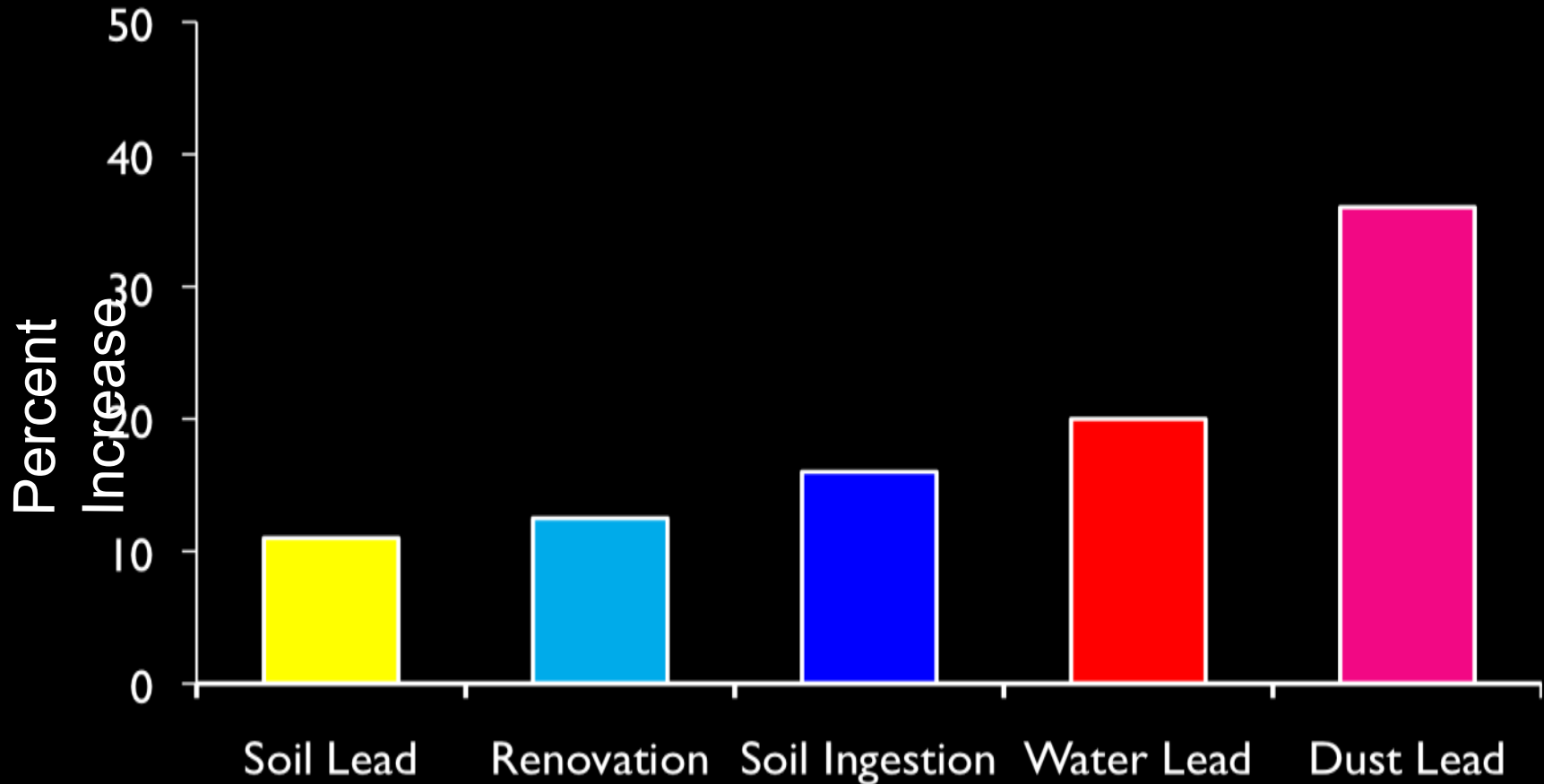




“The problem is so well defined, so neatly packaged, with both causes and cures known, that if we don't end this social crime, our society deserves all the disasters that have been forecast for it.”

Rene Dubos, 1967

Sources of Lead Exposure



Adapted from Spanier A, et al. *Env Res* 2014 and Lanphear BP, et al. *Journal of Pediatrics* 2002;140:40-47.

The Global Elimination of Lead Poisoning

- Set goal to achieve blood lead $< 1 \mu\text{g/dL}$ by 2030 for all American children
- Eliminate all non-essential uses of lead worldwide and develop regulations to control lead emissions
- Establish empirically-derived health-based standards for lead in air, house dust, soil and water
- Screen housing units for lead hazards before purchase or occupancy, after renovation and abatement
- Develop strategy to replace lead lines and replace or cover contaminated soils