Q&A Guide for Reporters

Updated September 10, 2023
2 publications

1. Lancet Planetary Health article – To be published 4:30 GMT, Sept 12, 2023. “Global health burden and cost of lead exposure in children and adults: a health impact and economic modeling analysis”, Larsen and Sanchez-Triana.

2. Pure Earth - Rapid Market Screening report - To be published 4:30 GMT, Sept 12, 2023, 12:01 am ET Sept 11, 2023. “Lead In Consumer Goods: A 25-country analysis of lead (Pb) levels in 5,000+ products and foods”

Lancet Planetary Health article

CARDIOVASCULAR DISEASE (CVD) DEATHS DUE TO LEAD

Q: How did you arrive at 5.5 million CVD deaths globally in 2019 due to lead exposure?

The estimate is calculated by looking at analysis in peer reviewed research articles that attribute CVD to lead exposure. 18.5 million people die from CVD globally each year. IHME has established research methods to distinguish what particular risks, like smoking or lead, can be apportioned to those 18.5 million deaths. See P6 for a brief overview of the steps undertaken for the model.

Q: Why is your estimate (5.5 million) more than 6 times greater than that of the Global Burden of Disease (GBD) for 2019 (0.85 million deaths)?

The GBD 2019 only looked at CVD as a result of high blood pressure from lead exposure. Our estimate looked at CVD from lead that is mediated through other mechanisms than high blood pressure. This includes atherosclerosis (hardening of arteries leading to cardiac arrest and stroke), reduced heart rate variability compromising long term cardiovascular health, and other cardiovascular effects. These effects of lead exposure appear to be much larger than the effect mediated through high blood pressure.

Q: Can you please describe, in lay terms, the difference between the methodology you used to estimate CVD mortality and IQ loss and what GBD used?

Our study's strengths are that we have: estimated IQ loss from lead exposure for the entire child population under five years of age rather than only for children at the lower end of the IQ scale that may end up with intellectual disability as a result of lead exposure; for the first time provided an indication of the possibly very large magnitude of global CVD mortality from lead exposure through mechanisms other than blood pressure; and found through sensitivity analysis that our results are fairly robust, with the exception that our estimated cost of IQ loss may very well be conservative.

Q: CVD risk is affected by numerous dietary and lifestyle factors. How were you able to tease out the contribution of lead exposure to CVD deaths?

Researchers have looked at the relationships between CVD and different risk factors – smoking- obesity – lead – and worked out what proportions of CVD are attributable to each.
Our new estimate places lead exposure as the third leading risk factor for global CVD mortality after high blood pressure and dietary risks, ahead of tobacco smoking and high cholesterol as estimated by IHME/GBD 2019.

Q: You note that CVD deaths due to lead exposure may be mediated by mechanisms other than elevated blood pressure. What are those other mechanisms?

There are multiple high quality studies attributing atherosclerosis to lead exposure – hardening of arteries, which leads to cardiac arrest and stroke. Lead also influences the autonomous nervous system, which affects heart rate variability. High-rate variability is a good thing as it reflects the flexibility of the heart to adjust its heart rate to different needs and it is related to better long-term cardiovascular health. Lead lowers heart rate variability. These and other types of cardiovascular effects are at play from lead exposure.

IQ LOSSES IN CHILDREN DUE TO LEAD

Q: You estimate that children under 5 years old lost 765 million IQ points in 2019. How much of a loss is that, on average, for an individual child?

95% of this loss was in children in low- and middle-income countries (LMICs). The average loss in these countries was 5.9 IQ points per child over their first five years of life.

Q: Why is your estimate of IQ loss in low- and middle-income countries (LMICs) nearly 80% higher than a previous estimate?

We estimated IQ loss based on an updated analysis of the relationship between IQ and lead exposure, and by recognizing that no safe level of lead exposure has been identified.

Q: Why is so much of the global IQ loss and mortality burden in low- and middle-income countries (LMICs)(90-95%), with little in high-income countries (HICs)?

Lead exposure – measured as blood lead levels (BLLs) - are higher in LMICs than in HICs , and have been for some time – LMICs have not experienced the same reductions in BLLs as HICs after the phase out of lead in gasoline. There has not been a focus on lead exposure in most LMICs, so actions have been very limited.

Q: Is your methodology for assessing IQ loss in children similar to methodologies typically used in the past? If different, can you please describe the differences in lay terms?

No difference – It's a modeling based on BLL and what the associated IQ loss is from that – this is a well-established methodology. However, the understanding among researchers of the magnitude of effect on IQ, especially from lead exposure below the BLLs that prevailed before the phase-out of lead in gasoline, has evolved over the last two decades.

Q: You note that global lead exposure has declined substantially since leaded gasoline's phaseout. Why, then, are the negative impacts of lead on IQ loss and CVD deaths so much greater than past estimates? Do you think that, despite the drop in overall lead exposure, the negative health impact is trending up rather than down?

Past estimates did not fully account for the full impact of lead exposure, and this explains why estimates are larger than in the past. The cardiovascular disease impact of lead is felt later in life, and it is likely that the global trend is down, having been most impacted during the times that lead was in gasoline.

Yet monitoring of lead and BLLs in LMICs has been very incomplete, with very few countries undertaking regular nationwide assessments, if at all. Newer sources of lead exposure are also being uncovered, as is shown in Pure Earth's Rapid Market Screening. Long term trends in LMICS need further research.

Q: Which countries experienced the greatest IQ losses in children and CVD deaths in adults (?) due to lead?

Please refer to data tables. Summaries of all information, including IHME data alongside the new data can be found at www.leadpollution.org

Q: How did you estimate the cost of IQ loss and cost of CVD deaths(?)?

The cost of IQ loss is the loss in productivity during working life from loss of IQ over that child's lifetime. Each cohort of children born with reduced intelligence has an associated loss of lifetime earnings. We estimate the cost of IQ loss in 2019 as the present value of loss in lifetime income from IQ loss. A relationship between IQ and income has long been established. In much-cited studies, Schwartz found an income effect of 1·76% per IQ point and Salkever found an effect of 2·09% for males and 3·63% for females. These effects include a positive direct effect of higher IQ on income, a positive indirect effect on income through increased schooling and likelihood of high school graduation, and a positive effect on lifetime labor-force participation and thus lifetime income. Multiple studies have used the estimates by these two studies for estimating the cost of IQ losses from lead exposure including in LMICs.

We estimated the cost of CVD deaths by assigning the so-called 'value of statistical life' (VSL) to each death. The VSL is calculated from individuals' willingness-to-pay for a reduction in the risk of death.

Q: So how do the global health effects and cost of lead exposure that you have estimated compare to other environmental pollutants ?

We estimated that the health effects and cost of lead exposure is of the same magnitude as the health effects and cost of $PM_{2.5}$ ambient and household air pollution combined. The latter is estimated by IHME as the leading environmental health risk factor globally.

Q&A ON RAPID MARKET SCREENING

Q: What is the Rapid Market Screening program?

The Rapid Market Screening program (RMS) is a global assessment of lead (Pb) concentrations in more than 5,000 samples of consumer goods and foods from markets across 25 low- and middle-income countries.

Q: What is new about this assessment and its findings?

While prior studies have identified lead in a variety of consumer goods, the geographic variations in lead exposure sources have been poorly understood. This assessment improves our understanding of which products are likely to be contaminated, and how contamination levels vary across a diverse set of low- and middle-income countries.

Q: Which countries were included?

The RMS was implemented in: Armenia; Azerbaijan; Bangladesh; Bolivia; Colombia; Egypt; Georgia; Ghana; the Indian states of Maharashtra, Tamil Nadu, and Uttar Pradesh; Indonesia; Kazakhstan; Kenya; Kyrgyzstan; Mexico; Nepal; Nigeria; Pakistan; Peru; the Philippines; Tajikistan; Tanzania; Tunisia; Turkey; Uganda; and Vietnam.

Q: How should the RMS results be used?

Pure Earth recommends the RMS data be used to identify possible trends and products that warrant further attention and assessment. The data should be viewed as suggestive, not conclusive or representative of all similar products in these countries.

Q: What are the Results by Product Type?

Across 5,010 samples from 25 countries, the following percentages of samples exceeded the relevant reference levels for that specific product type:

Across all 5,010 samples: 18% exceeded relevant reference levels
Ceramic foodware: 45% of 310 samples exceeded
Metallic foodware: 52% of 518 samples exceeded
Plastic foodware: 12% of 364 samples exceeded
Cosmetics: 12% of 815 samples exceeded
Toys: 13% of 781 samples exceeded
Paints intended for large surfaces: 41% of 437 samples exceeded
Paints for art, crafts, & special uses: 11% of 70 samples exceeded
Spices: 2% of 1085 samples exceeded
Sweets: 3% of 111 samples exceeded
Staple dry food (grains, flours, legumes): 1% of 362 samples
Traditional and herbal medicines: 4% of 54 samples exceeded

BLL study questions

Q: Which countries have BLL testing capacity, which don't? Why?
It is generally possible to get a blood lead level test in many countries but it is expensive and not funded by the government. The equipment to test BLL may not be available or accurate in many countries.

Q: What are the main barriers that stand in the way of gathering blood lead level data in individual countries? What about globally?

Few countries have taken the lead problem seriously, and only a couple have done studies of baseline blood lead levels that can be considered representative. Resources are lacking within countries, as well as from the global donor community. The issue has not been a high priority within most international agencies also, although interest is growing (e.g. World Bank, UNICEF, USAID).

Q: What relatively easy methods can be used to measure blood lead levels?

Blood can be drawn from vein and sent to a lab, but contamination issues need to be contained. Labs should be reliable and blood may need to be refrigerated as well. Alternatively, a finger prick can get capillary test of lead which can give immediate result that has been shown to be reliable. Newer, less expensive systems need to be developed for blood lead testing.

Q: How should governments, the global health community and funders respond to this research?

Given lead's enormous impact on health, education, violent crime, costs – lead ought to be a major priority of the development community, especially the global health community.

Summary overview of how health estimates are typically calculated, indicating steps in methodology of research.

Estimating the contribution of lead exposure to cardiovascular disease (CVD) deaths is a complex process that typically involves epidemiological research and statistical analysis. Here's a simplified overview of how such an estimate might be calculated:

1. **Data Collection:** Researchers gather data on lead exposure levels (e.g., blood lead levels) and CVD outcomes from various sources such as cohort studies, surveys, and medical records. This data also includes information on other factors associated with CVD such as age, gender, socio-economic status, and lifestyle choices (e.g., smoking).

2. **Risk Assessment:** Scientists analyze the collected data to determine the relationship between lead exposure and CVD controlling for other factors associated with CVD. Such individual studies form the basis for so-called meta-analyses of existing research to calculate an overall relative risk or odds ratio for CVD associated with different levels of lead exposure.

3. **Population Attribution:** Using the relative risk estimates, researchers calculate the population attributable fraction (PAF) of CVD deaths from lead exposure. The PAF represents the proportion of CVD deaths in the population that can be attributed to lead exposure.

4. **Global Estimation:** For a global estimate, organizations like the Institute for Health Metrics and Evaluation (IHME) may use sophisticated models that integrate data from multiple sources to estimate the PAF and the global number of CVD deaths that can be attributed to lead exposure.

5. **Peer Review:** To ensure the accuracy and credibility of the estimate, the research methods, data, and findings are typically subjected to peer review by experts in the field. Peer-reviewed research undergoes rigorous scrutiny before publication in reputable scientific journals.

6. **Policy and Public Health Implications:** Once the estimate is validated and published, it can inform public health policies and interventions. Governments and organizations can use this information to develop strategies to reduce lead exposure and mitigate its impact on CVD.