A conversation with Dr. Stephen Luby, November 13, 2017

Participants

- Dr. Stephen Luby – Director of Research, Center for Innovation in Global Health, Stanford University
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Note: These notes were compiled by GiveWell and give an overview of the major points made by Dr. Stephen Luby.

Summary

GiveWell spoke with Dr. Luby of Stanford University about two of GiveWell's open investigations: interventions to reduce lead poisoning and interventions to promote handwashing. Conversation topics included effects of lead exposure, difficulties in attributing lead contamination to specific sources, and several handwashing studies with which Dr. Luby has been involved.

Effects of lead exposure

Lead is the worst of the heavy metals – it is a widespread potent industrial toxin and does not have any helpful physiological functions. It is particularly insidious because it is mostly invisible, meaning that many of the public health problems it causes may never be attributed to it.

The presence of lead in the environment has wide-reaching impacts on health and cognition. The New York University (NYU) School of Medicine estimates that lead exposure results in ~$1 trillion in lost lifetime economic productivity (LEP) worldwide each year. This figure does not take into account the proposed linkage between lead exposure and crime rates.

Attribution of lead to specific sources

Methods for determining attributable risk

A central problem in designing interventions to mitigate lead exposure is that researchers do not know how much lead contamination is due to any particular source.

To get a better understanding of attributable risk from different lead sources, Dr. Luby believes it would be best to do a representative population-based assessment studying both urban and rural populations. He would begin by doing a survey to identify people with and without elevated blood lead levels (BLLs), then do a careful exposure analysis. This would involve both an epidemiological case control study and physical samples of lead.

Tracing sources of lead using isotopes

There are four different naturally occurring isotopes of lead, and the mix of isotopes in a sample of lead can be determined using mass spectrometry. Lead from different mines has different isotopic signatures, so if it is the case that different industries and manufacturers use lead from different mines, it might be possible for scientists to draw blood samples from people, look at the isotopic signature of the blood lead, and thereby approximate how much of the lead in each person's blood came from different sources.

This method is currently only hypothetical, but Dr. Luby believes that it is worth exploring because if it works it might solve many problems simultaneously. He estimates that such an experiment would cost on the order of hundreds of thousands of dollars.

Lack of funding

One reason that the data on attributable risk from different lead sources is so sparse is that there is little interest in funding work on lead exposure in low-income countries, despite its large impacts on cognitive development. High-income countries fund work on communicable diseases in low-income countries because there is a possibility that the diseases might come to their shores, but there is no similar motivation driving them to fund research on lead.

Examining risk from particular sources of lead

Rural Bangladesh case control study

Dr. Luby's team found elevated BLLs in people in Chandpur District, Bangladesh, which was unexpected because Chandpur has no obvious sources of lead exposure, such as heavy industry or lead acid battery recycling.

The team did a case control study with a sample size of 430 people, comparing those with high BLLs to those with low BLLs. Dr. Luby assumed that there was a particular source of lead the team had missed, and powered the study to look for a single source. However, he now believes that there are multiple sources, some of which the team still does not understand.

<u>Sources</u>

Dr. Luby's team explored several possible sources of lead exposure, but found that none of them satisfactorily explained the elevated BLLs. The sources examined were:

- **Pesticides** – The team's initial hypothesis was that lead arsinate was being used as a low-cost pesticide, such that people were directly contaminating their agricultural products with lead. The team sampled many pesticides, but did not find any containing lead arsinate. They did tie reports of past use of particular kinds of pesticide to elevated BLLs, but these pesticides had been banned by the time of the study.
- **Paint** – People in Chandpur were not using paint at all, so this cannot have been a contributing factor.
- **Food cans** – Dr. Luby's team found some association between high BLLs and storing food in old cans that had been repaired with lead solder, but

they do not think this accounts for a significant fraction of the lead that people are exposed to.

- **Turmeric** – Dr. Luby's team found that some turmeric in rural Bangladesh is adulterated with lead chromate, but it is unlikely that this is a major factor contributing to high BLLs.

Lead paint

Despite the global focus on lead paint, Dr. Luby does not know of any data in existence that would allow researchers to calculate the attributable risk of the global lead burden that is due to paint. A rough estimate of the impact of lead paint could be obtained using data from studies in the United States that track lead exposure in children before and after lead abatement.

It is plausible that it is not worth running a study to find the attributable risk from lead paint because the world is already close to eliminating lead paint regardless, and because even if only 1% of lead poisoning is attributable to lead paint, that implies that use of lead paint results in ~$10 billion in LEP, which is clearly worth addressing.

Recycling of lead acid batteries

Dr. Luby expects that battery recycling is a much larger contributor to lead contamination than is generally acknowledged. The battery recycling industry has shifted to low-income countries because the low environmental standards in those countries mean that the process is much less expensive there than in developed countries. Battery recycling tends to be an informal, unregulated industry, and results in large amounts of exposure for workers and those who live in the area, which has an enormous impact on cognitive development.

<u>Possible interventions</u>

Successful interventions to reduce lead exposure from battery recycling should target occupational safety. This would include advocacy, as well as research on what policies or incentive structures are needed to formalize the battery recycling industry, since there do not currently exist good models of what good worker safety looks like in weak states.

Handwashing

Dr. Luby also works on promoting handwashing to prevent disease in developing countries. The evidence suggests that in highly contaminated settings, the families of individuals who wash their hands frequently have less disease.

Karachi efficacy study

Dr. Luby's team conducted an efficacy study on handwashing in Karachi, Pakistan. The researchers ensured the availability of soap, water, and convenient handwashing stations, making the environment supportive of adopting a hand washing habit. They also communicated the benefits of handwashing to people directly, and enlisted 'behavior change champions' to encourage people to wash hands and to address problems on the ground.

As a result of their intervention, Dr. Luby's team saw marked reductions in reported diarrheal and respiratory disease. However, it is important to note that this was an efficacy study, not an at-scale intervention. It is possible to obtain high levels of handwashing in an efficacy study because researchers can personally ensure optimal conditions, but this is not feasible at scale.

WASH Benefits Study

Dr. Luby was involved in the WASH Benefits Study, which "provides rigorous evidence on the health and developmental benefits of water quality, sanitation, handwashing, and nutritional interventions during the first years of life." The results of this study that pertain to handwashing have not yet been published.

Sanitation, Hygiene Education and Water Supply in Bangladesh

Dr. Luby's team evaluated the Sanitation, Hygiene Education and Water Supply in Bangladesh (SHEWA-B) project, which included handwashing among several other interventions.

At the beginning of SHEWA-B, the interpersonal communication component of the intervention was not implemented effectively, such that no effect of the intervention could be demonstrated. UNICEF was informed of this within two years of beginning the program, and responded by including a mass media component.

The mass media component made the program more difficult to assess because there were no longer intervention and non-intervention groups. However, markers of hand washing – particularly the availability of soap and water in households – improved after the intervention, suggesting that the mass media campaigns had some positive effect on handwashing behavior.

Interventions at scale

The data on what specific interventions successfully improve handwashing practices at scale in high-need settings is very limited. Some of Dr. Luby's ideas in this area include:

- **Low-cost alternatives** – There may be unexplored ways to reduce costs for at-scale handwashing interventions. For example, detergent mixed with water costs one-tenth as much as bar soap, and for advocacy, mass media campaigns are a more cost-effective approach than interpersonal communication.
- **Habit adoption –** Dr. Luby believes that 'habit adoption' is a better frame for handwashing than 'behavior change,' because it focuses on changes that can be made to the environment rather than on the behavior of individuals.
- **Evaluation –** Dr. Luby suggests that groups funding handwashing interventions should include a small amount of additional funding for

evaluations of those interventions. The evaluations need not be prohibitively complex, just thoughtfully designed and sufficiently powered to generate new knowledge.

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