



## Pollution and children's health

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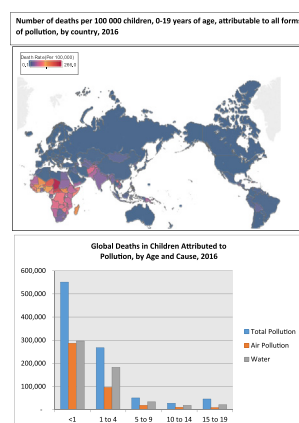
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### HIGHLIGHTS

- Pollution was responsible in 2016 for 940,000 deaths in children, two-thirds under age 5.
- 92% of pollution-related deaths in children occur in low- and middle-income countries.
- Most are due to respiratory and gastrointestinal diseases caused by polluted air and water.
- Pollution is linked also to multiple NCDs in children. These diseases are on the rise.
- Pollution prevention is a major opportunity to prevent disease and improve children's health.

### GRAPHICAL ABSTRACT



### ARTICLE INFO

#### Article history:

Received 10 July 2018

Received in revised form 10 September 2018

Accepted 29 September 2018

Available online 02 October 2018

Editor: Pavlos Kassomenos

#### Keywords:

Pollution;  
Children's environmental health;  
Non-communicable diseases;  
Global health;  
Prevention

### ABSTRACT

**Findings:** The *Lancet* Commission on Pollution and Health found that pollution – air, water, soil, and chemical pollution – was responsible in 2016 for 940,000 deaths in children worldwide, two-thirds of them in children under the age of 5. Pollution is inequitably distributed, and the overwhelming majority of pollution-related deaths in children occurred in low- and middle-income countries (LMICs). Most were due to respiratory and gastrointestinal diseases caused by polluted air and water.

Pollution is linked also to multiple non-communicable diseases (NCDs) in children including low birth weight, asthma, cancer and neurodevelopmental disorders, and these diseases are on the rise. The full impact of pollution, especially chemical pollution on the global burden of pediatric disease is not yet known, but almost certainly is undercounted because patterns of chemical exposure are not well charted and the potential toxicity of many chemical pollutants has not been characterized. The list of pediatric NCDs attributed to pollution will likely expand as the health effects of newer chemical pollutants are better defined and additional associations between pollution and disease are discovered.

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<sup>1</sup> were co-chairs of the *Lancet* Commission on Pollution and Health and Drs. Suk, Sly and Chiles were members of the Commission.

**Conclusion:** Pollution prevention presents a major, largely unexploited opportunity to improve children's health and prevent NCDs, especially in LMICs. Failure to incorporate pollution prevention into NCD control programs is a major missed opportunity for disease prevention.

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## 1. Introduction

Pollution is the world's largest environmental cause of disease and premature death. It is responsible for an estimated 9 million deaths per year—16% of all deaths worldwide— three times more deaths than AIDS, tuberculosis, and malaria combined (Landrigan et al., 2017). In the most severely affected countries, pollution is responsible for more than one death in four. Children are exquisitely sensitive to pollution (Suk et al., 2016).

Despite the great magnitude of the problem, pollution has been neglected in the international development and global health agendas.

To end this neglect, raise awareness of pollution's impacts, and mobilize the resources, political leadership and civic will needed to control pollution and prevent pollution-related disease, the *Lancet* Commission on Pollution and Health was formed in 2015. This Commission undertook a comprehensive analysis of pollution and its effects on human health and the global economy and disseminated its findings in October 2017 (Landrigan et al., 2017). This review is based on the *Lancet* Commission report and highlights pollution's impacts on the health of children.

## 2. Findings of the *Lancet* Commission on Pollution and Health

### 2.1. The global burden of pollution-related disease

Using data from the Global Burden of Disease study (Forouzanfar et al., 2015a and 2015b), the *Lancet* Commission found that air pollution is the largest cause of pollution-related disease. Air pollution is responsible for an estimated 6.4 million deaths per year - 4.2 million from ambient air pollution (HEI/IHME, n.d.) and 2.8 million from household air pollution (Smith et al., 2014; Yadama, 2013). Water pollution is responsible for an estimated 1.8 million deaths annually. Occupational pollutants – dusts and carcinogens kill an estimated 800,000 people. Lead is responsible for approximately 500,000 deaths each year and additionally causes widespread, but inadequately quantified impairment of cognitive function and behavior.

The *Lancet* Commission found that in many places and especially in the growing cities of rapidly developing low- and middle-income countries, pollution – especially, ambient air pollution and chemical pollution - is getting worse. The numbers of deaths due to pollution-related disease are projected to rise still further in coming decades unless aggressive interventions are undertaken (Lelieveld et al., 2015). Key drivers of these increases are the uncontrolled growth of cities; rising demands for energy; mining; smelting; deforestation; the global spread of toxic chemicals; increasingly heavy applications of toxic insecticides and herbicides; and the growing global use of petroleum-powered cars, trucks, and buses.

### 2.2. Pollution and non-communicable disease

The *Lancet* Commission noted that pollution is a major cause of non-communicable diseases (NCDs) in persons of all ages - responsible for 16% of all NCD deaths globally. The impact of pollution on NCD mortality is especially strong in heavily polluted low- and middle-income countries where it exceeds the impacts of tobacco, alcohol and obesity (Landrigan et al., 2017; Fuller et al., 2018). In 2015, all forms of pollution combined were responsible for 21% of all deaths from cardiovascular disease, 26% of deaths due to ischemic heart disease, 23% of deaths

due to stroke, 51% of deaths due to chronic obstructive pulmonary disease, and 43% of deaths due to lung cancer (Landrigan et al., 2017).

### 2.3. Toxic chemical pollution

The Commission considered chemical pollution to be a great and growing threat to children's health. An estimated 140,000 new chemicals and pesticides have been invented and manufactured since 1950, and many have become widely disseminated in the earth's environment (Landrigan and Goldman, 2011; Prüss-Ustün et al., 2011). Patterns of exposure to manufactured chemicals are poorly mapped in most countries, and the toxicity of the majority of chemicals in commerce has never been evaluated.

### 2.4. Pollution, poverty and human rights

The *Lancet* Commission found that pollution is deeply intertwined with poverty and injustice and stated that pollution threatens fundamental human rights - the right to life, the right to health, the right to well-being, and the rights of the child (United Nations, 1948). Ninety-two per cent of pollution-related deaths occur in low- and middle-income countries - environmental injustice on a global scale, and in countries at every income level, pollution and pollution-related disease are disproportionately concentrated in poor, minority and marginalized communities (Bullard, 1990).

Pollution is not only a consequence of poverty. It can also cause and deepen poverty by producing disease, dysfunction, premature death that results in diminished economic productivity, lost income and increased health-care costs for already impoverished families (Furie and Balbus, 2012). In children, early-life exposures to neurotoxic pollutants can permanently impair cognitive function thus contributing to school failure and reduced lifetime earnings.

Globalization is a powerful driver of the increasing concentration of polluting industries in low- and middle-income countries. Globalization has resulted in the relocation of industries such as chemical manufacture and steel-making from higher income countries to poorer countries where wages are often low, environmental and occupational regulations non-existent and not enforced, and the public health infrastructure weak. Seventy per cent of heavy chemical manufacture today occurs in low- and middle-income countries.

Globalization results also in the trans-shipment of hazardous materials from high-income countries where they are produced to low- and middle-income countries – another example of global environmental injustice. Such dumping includes the shipment of hazardous pesticides, industrial waste, electronic waste (e-waste), and toxic chemicals. Well publicized examples include the transport in 2006 of 500 tons of toxic chemical wastes from Amsterdam to Abidjan, Cote d'Ivoire aboard the vessel *Probo Koala*; the subsequent release of these chemicals resulted in 17 deaths and in >100,000 cases of illness (Margai and Barry, 2011). Another example is a large e-waste site at Agbogbloshie, Ghana where thousands of discarded computers, cell phones, kitchen appliances and other electronics have been shipped from European ports in containers misleadingly labelled “secondhand goods” (Caravanos et al., 2011).

### 2.5. Pollution is costly

The *Lancet* Commission undertook economic analyses and found that pollution is very costly. Pollution causes productivity losses by

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