

Pollution prevention and climate change mitigation: measuring the health benefits of comprehensive interventions



Pollution and climate change are two hallmarks of the Anthropocene Age; they are grave consequences of human activity on planetary health.¹⁻⁴ These twin threats arise from many of the same sources: the burning of fossil fuels for electricity generation and of biomass fuels for cooking and heating, modern globalised systems of production and transportation, mechanised agriculture, urbanisation, and the growing global manufacture and use of toxic chemicals. Both have their origins in the linear, take-make-use-dispose economic model, that Pope Francis has termed the “throwaway culture”, in which natural resources and human capital are viewed as inexhaustible and expendable, and consequences in the long term are seldom considered.⁵

Pollution and climate change have widespread effects on human health. Pollution is the largest environmental cause of disease and death today. It kills an estimated 9 million people per year and sickens millions more; more than 70% of deaths related to pollution are due to non-communicable diseases.¹ Unmitigated climate change driven by carbon pollution threatens the viability of organised human societies. It leads to disease and premature death, for example by: increasing the frequency and severity of extreme weather events, such as heatwaves, wildfires, violent storms, floods, and droughts; altering the pattern and distribution of vector-borne diseases; reducing crop yields; and probably contributing to population displacement.^{3,6} The effects of climate change on human health are increasingly common, but they are not yet well quantified and are poorly captured in the Global Burden of Disease (GBD) metrics.^{7,8}

Low-income and middle-income countries bear the brunt of the burden of disease and premature death caused by both pollution and climate change. 92% of pollution-related deaths occur in these territories,¹ which are subject to disproportionate health effects of climate change because they often lack the resources to adapt.⁶

The effects of pollution and climate change, for the most part, have been considered separately, and progress toward controlling these two threats has been tracked using different metrics. The health effects of pollution are quantified as disease burden and premature deaths through the GBD study,⁷ whereas

climate change is tracked through trends in atmospheric CO₂, global temperature, and patterns of precipitation, as well as by monitoring progress on mitigation and adaptation.² However, this artificial separation ignores the common origins and transposable effects of many health toxins and climate pollutants, such as tropospheric ozone and black carbon,⁹ and, most importantly, does not quantify the impacts of climate change on human health. This division is also inefficient and can result in missed opportunities for disease prevention. Finally, this separation undercuts public support for mitigation of climate change because it obscures recognition of the fact that its comprehensive management, together with pollution prevention, can produce benefits not only for the planet in the years ahead, but also for human health and the economy in the present day.

Bold and comprehensive strategies that simultaneously address both problems are needed to overcome the separation between pollution prevention and climate change mitigation. Examples are the widespread adoption of wind and solar power, construction of high-speed public transport systems, and the design of healthy, walkable, human-centred cities. When such interventions are backed by strong regulations and vigorous enforcement, they have the potential to produce immediate reductions in the diseases caused by toxic pollution, while at the same time mitigating climate change. They can avert the mistakes arising from single-track thinking that focuses only on one issue without regard for the other. Moreover, because pollution control is often highly cost-effective, comprehensive programmes have high potential to produce measurable returns on economic investment in both the short and long terms.

Transparent and readily understandable metrics that document the effectiveness of comprehensive interventions are as important as the interventions themselves. To the extent possible, these metrics need to be grounded in the GBD methodology. Careful tracking of the impacts of comprehensive interventions on human health will document that pollution control and climate change mitigation reduce the global

burden of disease and prevent premature death. Such documentation will build political support for local and national leaders who are conscious of the wellbeing of their general population, as well as the health of the planet.

Various collaborations are now being developed or are underway to quantify the benefits of pollution prevention and climate change mitigation, including the Global Observatory on Pollution and Health at Boston College;¹¹ the Center for Climate Change and the Center for Climate, Health and the Global Environment (C-CHANGE) at the Harvard TH Chan School of Public Health; extensive collaborative work coordinated by the London School of Hygiene & Tropical Medicine;^{4,9} and The *Lancet* Countdown on Health and Climate Change. The *Lancet* Countdown's 2018 report will provide global mortality estimates for PM_{2.5} attributed to specific sources, such as power plants fuelled by coal.¹² The Wellcome Trust's recent call for proposals that assess the health benefits of actions to mitigate climate change will stimulate further work in this area.¹³

Close coordination between these efforts and the GBD study will be essential to ensure that the health effects of both toxic pollution and climate change are captured and quantified in the GBD estimates, and thus translated into health policy in the ever increasing number of countries that use GBD data as a key policy guide.⁴ While current estimates of the burden of pollution-related disease and death are almost certainly too low and fail especially to capture the health effects of many newer chemical pollutants,¹ they nonetheless document the great magnitude of the problem and provide a benchmark for tracking future progress.

The challenge now is to break down the barriers that separate programmes and disciplines, and to report the health and economic benefits of both pollution prevention and climate change mitigation together, as part of national policies to reduce greenhouse gas emissions. Integration of pollution control with climate change mitigation against a background of rigorous quantification will mark an important advance for

planetary health and produce measurable benefits for human wellbeing.

*Philip Landrigan, Richard Fuller, Andy Haines, Nick Watts, Gina McCarthy

Schiller Institute for Integrated Science & Society, Boston College, Chestnut Hill, MA, 02467, USA (PL); Pure Earth, Blacksmith Institute, New York, NY, USA (RF); London School of Hygiene & Tropical Medicine, London, UK (AH); Institute for Global Health, University College London, London, UK (NW); and Center for Climate, Health and the Global Environment, Harvard TH Chan School of Public Health, Boston, MA, USA (GC)
phil.landrigan@bc.edu

We declare no competing interests.

Copyright © The Author(s). Published by Elsevier Ltd. This is an Open Access article under the CC BY 4.0 license.

- 1 Landrigan PJ, Fuller R, Acosta NJR, et al. The *Lancet* commission on pollution and health. *Lancet* 2018; **391**: 462–512.
- 2 Intergovernmental Panel on Climate Change. Climate change 2014 synthesis report summary for policymakers. http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf (accessed May 30, 2018).
- 3 Watts NA, Ager WN, Agnolucci P, et al. Health and climate change: policy responses to protect public health. *Lancet* 2015; **386**: 1861–914.
- 4 Whitmee S, Haines A, Beyrer C, et al. Safeguarding human health in the Anthropocene epoch: report of The Rockefeller Foundation—*Lancet* Commission on planetary health. *Lancet* 2015; **386**: 1973–2028.
- 5 Pope Francis. *Laudato Si'* encyclical letter on care for our common home. Vatican City Holy See: Vatican Press, 2015.
- 6 WHO. Climate change and health. 2018. <http://www.who.int/mediacentre/factsheets/fs266/en/> (accessed May 30, 2018).
- 7 GBD 2015 Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet* 2016; **388**: 1659–724.
- 8 Hu H, Landrigan PJ, Fuller R, et al. A new initiative to enhance global burden of disease estimates for pollution and climate change. *Lancet Planet Health* (in press).
- 9 Haines A, McMichael AJ, Smith KR, et al. Public health benefits of strategies to reduce greenhouse-gas emissions: overview and implications for policy makers. *Lancet* 2009; **374**: 2104–14.
- 10 WHO, Climate and Clean Air Coalition. Reducing global health risks through mitigation of short-lived climate pollutants: scoping report for policymakers. 2015. <http://www.ccaoalition.org/fr/resources/reducing-global-health-risks-through-mitigation-short-lived-climate-pollutants-scoping> (accessed May 30, 2018).
- 11 Landrigan PJ, Fuller R, Hu H, et al. Pollution and global health—an agenda for prevention. *Environ Health Perspect* 2018; **126**: 084501.
- 12 Watts N, Amann M, Ayeb-Karlsson S, et al. The *Lancet* Countdown on health and climate change: from 25 years of inaction to a global transformation for public health. *Lancet* 2018; **391**: 581–630.
- 13 Wellcome Trust. Climate change and health awards. <https://wellcome.ac.uk/funding/climate-change-and-health-awards> (accessed Aug 26, 2018).

For more on C-CHANGE see <https://www.hsph.harvard.edu/c-change/>