Pollution – The World’s Largest Environmental Cause of Disease

Preliminary Results

Philip J Landrigan, MD, MSc, FAAP
Richard Fuller, BE
Pollution Defined

• Any material introduced into the environment as the result of human activity that endangers human health or harms living resources and ecosystems.

• The focus of this Commission is on the human health effects of pollution.

• This Commission does not evaluate the environmental impacts of pollution or health effects of pollution mediated through ecosystem change.
Commission Aim

To raise global awareness of the great and growing magnitude of the problem of pollution and end neglect of pollution-related disease.
Indoor air pollution.
Kills over 3 million per year
Ambient Air Pollution, New Delhi 2016
Worst pollution event since London 1952
E-waste burning, Ghana
Globalization of Chemical Production

Deaths from Methyl Isocyanate
Bhopal, India
Asbestos Export to Developing Countries

• Two million tons of new asbestos are produced each year
• Most is exported to the world’s poorest countries
• In south Asia, asbestos consumption is increasing at >10 % per year
• Used mainly in construction
• 5-10 million total deaths from asbestos cancers projected by 2030
Gold smelting in the home. Exposure of entire family.
Informal battery recycling.
Local lead poisoning
Scope of the Commission’s Review

• Ambient air pollution - fine particulate (PM$_{2.5}$) pollution and tropospheric ozone pollution;
• Household air pollution;
• Water pollution – unsafe water source and inadequate sanitation;
• Occupational exposures to chemical toxicants;
• Soil pollution caused by heavy metals and toxic chemicals; and
• Lead
• 52 Authors
• Leaders - UNEP, WHO, World Bank, CDC, ADB, IHME, UNIDO
• Ministers of Health/ Ministers of Environment – Senegal, China, Madagascar, India, Indonesia, Mexico, Kazakhstan
• Top scientists – Harvard, Stanford, Columbia, Mount Sinai, LSE, LSH&TM, IIT
• Co-chairs – Philip Landrigan, Richard Fuller
• Funders: European Commission, USAID, Federal Environment Ministry Germany, Ministry Environment Sweden, US NIEHS
Data Sources

• Institute for Health Metrics and Evaluation
  2015 Global Burden of Disease analysis

• World Health Organization
  2012 Burden of Disease analysis

• Pure Earth/GAHP Toxic Sites Inventory Program
  Soil pollution at contaminated sites
Report Structure
Four Chapters

• Health Outcomes – Global Burden of Death and Disability due to Pollution Related Disease
• Economic Impacts- Productivity losses, costs to health care services, and social costs (willingness to pay)
• Inequality/Injustice review
• Solutions and strategies
Pollution is the World’s Largest Environmental Cause of Death

Deaths from Pollution Versus Other Major Risk Factors

- Ebola
- War and Murder
- Road Accidents
- Malnutrition
- Drug and Alcohol Use
- AIDS, Malaria & TB
- Diet High in Sodium
- Tobacco Smoking
- Total Pollution
Deaths Due to Pollution are Increasing

Major drivers:

• Urbanization – over 50% of global population now resides in cities. Populations are exploding in third world mega-cities
• Increasing use of motor vehicles
• Increasing industrialization
• Globalization. Relocation of hazardous industries and toxic chemicals to developing countries, where public health infrastructure and environmental protection is often weak
Pollution and Disease are Changing
Deaths from modern pollution now predominate over deaths from traditional pollution

The Environmental Risk Transition
70% of pollution-related disease is non-communicable disease
Pessimistic Future Outlook

Under a “business as usual scenario” that assumes implementation of current rules on air pollution but considers no possible new interventions, the numbers of deaths due to fine particulate ($PM_{2.5}$) air pollution will continue to rise over the next three decades with sharpest increases in cities in South and East Asia.

This will result in projected increases in global mortality from air pollution from 4.2 million deaths in 2015 to 6.6 million deaths in 2050 (95% CI, 3.4–9.3 million), an increase of more than 50%.

*Lelieveld et al., 2015*
More Optimistic Future Outlook

Aggressive control measures could avoid 23% of mortality attributable to fine particulate (PM$_{2.5}$) air pollution.

Because the exposure-response curve is steep at low levels but flatter at higher levels, equivalent control measures will yield greater benefits in less heavily polluted regions.

Apte et al., 2015
Climate Change & Pollution – Linked Through Multiple Pathways

Fuel combustion accounts for 85% of airborne particulate pollution, for almost all emissions of sulfur oxides and nitrogen oxides, and is a major source of greenhouse gases. Climate change has potential to worsen levels of ambient air pollution and to aggravate the effects of pollution on health. Both pollution and climate change can be mitigated by transition toward a more sustainable economy.
Coal-Fired Power Plant

Coal combustion is the single largest source of both air pollution and greenhouse gas emissions.
The Growing Challenge of Pollution by Toxic Chemicals and Pesticides

U.S. chemical production, 1947–2007

Production index (100 = year 2002)
The global problem of exposure to untested chemical pollutants

- Chemicals known to be toxic to human neurodevelopment
- Chemicals known to be neurotoxic in humans
- Chemicals known to be neurotoxic in experiments
- Chemical universe

$n=12$

$n=201$

$n>1000$

$n>80,000$
Pollution is a Human Rights Issue

- 92% of deaths from pollution-related disease occur in low- and middle-income countries.
- In countries at all income levels, pollution disproportionately affects the poor and marginalized.
- Women, children, the elderly and minorities are the main victims.
- Contrast these sad realities with Pope Francis’ visionary social and environmental teaching in his encyclical, *Laudato Si’*. 
Pollution death rates are highest in poor and rapidly industrializing countries. 92 percent of deaths is in LMICs.
Pollution Deaths by Country Income
Children are exquisitely sensitive

- Greater exposure proportionate to body mass—
  *7 times more water per Kg per day; Hand-to-mouth activity*
- Diminished ability to detoxify many chemicals
- Heightened biological vulnerability—e.g., thalidomide, DES, fetal alcohol syndrome, lead
- More years of future life
Pollution Control is Essential to Attainment of the SDGs

- Pollution control is an explicit SDG priority
  - Goal 3.9: “By 2030, substantially reduce the number of deaths and illness from hazardous chemicals and air, water and soil pollution and contamination.”

- Progress on pollution advances all SDGs, especially
  - Goal 1: end poverty
  - Goal 6: clean water
  - Goal 11: sustainable cities
  - Goal 12: responsible production and consumption
  - Goal 13: slow climate change – Progress toward SDG 13 will help to control pollution
Pollution is Extremely Costly

Data to be presented by Prof. Maureen Cropper of the University of Maryland, a member of the Commission and lead author for Chapter 2
Pollution is Undercounted
Its Solutions Are Underfunded

Deaths

Development Assistance $

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<th>Deaths (millions)</th>
<th>Development Assistance</th>
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<td>Total Pollution</td>
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<td>AIDS, Malaria &amp; Tuberculosis (2012)</td>
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Recommendations

In its final report, the Commission plans to make recommendations to:

• The international community – UN agencies, overseas development agencies, foundations and NGO’s
• Governments at all levels – city, state, and national
• Private sector
• Health professionals
• Research
Thank You