

Climate Change, Air Pollution and Public Health

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ABSTRACT

Climate change is the universal phenomenon leaves no part of the world untouched for the more than tow decade scientists have indicated that the earth's climate is rapidly changing. Air pollutants are under scientific scrutiny not only for what they do to our lungs and health, but also how they enhance climate impacts and associated health risks. Science does not allow us to keep the local public health impacts of air pollution and the global warming impacts of green house gases in silos any more. The emerging science has given us more reasons to be worried about air pollution. This demands an integrated frame work for mitigation to minimize public health risk.

Air Pollution and Public Health Challenge

The impacts of air quality on urban health outcomes are more complex than temperature impacts, owing to the variable distribution and behavior of a large number of pollutants that effect different disease categories, such as respiratory and cardiovascular illnesses and allergies. Stricter air quality standards have improved health in many high-income countries; for example, between 1970 and 2020, reductions in fine PM accounted for as much as 15 percent of the overall increase in life expectancy in 51 US metropolitan areas. In cities of low-income and middle-income countries, however, air quality continues to deteriorate and to impose increasingly greater health burdens on growing populations that use large amounts of energy to meet domestic and industrial needs.

It is worrying that even after decades of air quality management, particulate has remained among top 10 killers globally with disproportionality high health impacts in the developing world. The recent global burden of disease (GBD) estimates shows that in India alone, more than 627,000 people die prematurely and 18 million healthy life years are lost every year due to ill health connected especially with the tiny particles.

There are now myriad studies across the world and also in India to prove that outdoor urban air pollution is a serious environmental risk factor that causes or aggravates acute and chronic diseases. Also, given the latency period of toxic risk in environmental health risk. This makes a strong case for control to be built into the air pollution control policies more clearly.

According to the GBD, toxic air worsens symptoms of ischemic heart disease, stroke, chronic obstructive pulmonary disease, asthma, lung cancer and acute lower respiratory tract infection. This causes premature deaths and loss of healthy life years due to illness. India specific GBD shows ischemic heart disease causes half of the total air pollution related premature death in India with strokes causing more than a quarter. The rest is dominated by respiratory conditions and cancer.

Most vulnerable are the children, elderly and those with respiratory and cardiac conditions. Even healthy people are vulnerable from prolonged exposure. According to the recent estimates of the World Bank, South Asia's urban population is poised to grow by almost 250 million people by

2030. Most of the growth will take place in India. This will bring significant number of children within toxic urban environment. Because their lungs are still developing, children are most vulnerable to the impact of air pollution.

Polluted air has also compromised the health of our future generations in cities like Delhi. Considerable evidence has come from the epidemiological study on children in Delhi carried out by CPCB and Chittranjan National Cancer Institute in Kolkata and published in 2012. This study had covered 11,628 school-going children from 36 schools in different parts of Delhi and in different seasons. Every third child had reduced lung function. There is a marked increase in the number of bio-makers like alveolar macrophages (the first line of cellular defense against inhaled pollutants) in the sputum of children. This shows greater exposure to particulate pollution. Sputum of children in Delhi contains four times more iron-laden macrophages than those from cleaner environs, indicating pulmonary haemorrhage. The study found the level of these bio markers higher in children from areas with high particulate levels.

Studies are dominated by the focus on respiratory symptoms. But in the recent years they have begun to include more diverse health end points-cardiac cases, cancer, mutagenic effects, etc. Though this investigation in India is still very nascent, global studies have made more robust linkages with a wide range of health endpoints-diabetes, stroke, hyper tension, effects on brain, effects on foetus etc. Given the fact that endpoint of all toxic risk is cancer, all environmental risk factors should be minimized, This is particularly serious in India that report overall over 700, 000 new cancer cases and National cancer Control Programme (NCCP) forecast that by 2026, more than 1.4 million people will be falling in the grip of the disease, NCCP has listed grater exposure to environmental carcinogens as one of the most important reasons. The mitigation strategy must reduce environmental risk from all factors and air pollution is an important factor. Numerous studies in the West assessed the causes such as genetic susceptibility, environment factors and lifestyle.

This trend in public health risk is expected to get worse if the pollution trends remain business as usual and the global warming impacts get further enhanced

Air Pollution and Climate Impacts: Demystifying Link

While both rural and urban environments are getting increasingly toxic, the planet is also getting warmer. The climate scientists have warned that planet cannot afford to warm up beyond 2 degree C. but the link between public health impact of air pollution in a warmer climate is often not well understood; nor, the impact of air pollution on warming of the climate and further enhancement of health risk.

Air Pollution and Public Health of Warming

A range of toxic pollutants and the warming gases are co-emitted from vehicles, industry, power plants and cooking stoves. In urban and rural environment. The toxic pollutants including tiny particles, nitrogen oxides, ozone, sulfur dioxide, carbon monoxide also contribute through secondary transformation in the atmosphere to the load of warming gases like carbon dioxide, methane, black carbon etc. This transformation is subtle but significant. For example, hydrocarbons and nitrogen oxides react to create regional ozone and also contribute to hemispheric ozone that warms. The tiny particles of less than 10 and 20.5 micrometer size that are health damaging also have black carbon that absorbs heat and warms the atmosphere.

There are already evidences to suggest that increased frequencies in extreme weather events especially heat waves and heat island conditions further enhance air pollution and public health risk. Studies have shown that each increase of 1 degree Celsius cause by carbon dioxide concentration can enhance particulate and ozone build up. This can lead to thousands of additional deaths and many more illness. Some of the key indicators of this change are ozone build up and formation of secondary particulates. Warmer temperatures and the extreme heat waves are threatening to increase the frequency of days with unhealthy levels of ozone, with serious public health consequences.

These pollutants are rarely monitored in India cities. But Delhi has begun to monitor ozone. Delhi witnesses significant ozone build-up during summer. A study of the real-time air quality data available from the key monitoring locations of the Delhi pollution Control Committee (DPCC) for the period January to June in any year shows rapid build-up of ozone and more frequent violation of standards this summer. Ground-level ozone is not directly emitted by any source. This is formed when oxides of nitrogen (NO_x) and a range of volatile gases- primarily from vehicles and other sources- are exposed to each other in sunlight. Warm and stagnant air increases the formation of ozone, which is known to be extremely hazardous for human health.

Climate Change Impact of Air Pollution

Air pollution changes our planet's climate, but not all types of air pollution have the same effect. There are many different types of air pollution. Some types cause global warming to speed up. Others cause global warming to slow down by creating a temporary cooling effect for a few weeks. Read on to learn more about the pollution that caused Earth to warm and the pollution that causes Earth to cool. Some air pollutants cause more global warming. Air pollution includes greenhouse gases. One of these is Carbon dioxide; a common part of the exhaust from cars and trucks. Greenhouse gases cause global warming by trapping heat from the Sun in

the Earth's atmosphere. Greenhouse gases are a natural part of Earth's atmosphere, but in the last 150 years or so, the amount in our atmosphere has increased. This increase comes from car exhaust has increased. The increase comes from car exhaust and pollutants released from smokestacks at factories and power plants. The increase in greenhouse gases is the cause of most of the global warming that happened over the past century. Scientist predict that much more warming will likely happen during the next century.

Some air pollutants slow down global warming. Cars, trucks and smokestacks also release tiny particles into the atmosphere. These tiny particles are called aerosols. They can be made of different things such as mineral dust, sulfates, sea salt, or carbon. Some of these particles get into the atmosphere naturally. They are dust lifted into the atmosphere from deserts, from evaporating droplets from the ocean, released by the smoke from wildfires, and erupting volcanoes. But air pollution released by humans by burning of fossil fuels fuel also adds them to the atmosphere. Aerosols have an impact on climate. While different types of aerosols act differently in the atmosphere, the overall effect of aerosols is cooling. Greenhouse gases stay in the atmosphere for years and cause warming around the world. Computer models indicate that, worldwide, the tiny aerosols cause about half as much cooling as greenhouse gases cause warming.

However, science has also changed our understanding about the role that some of the short lived gases and particles like black carbon, methane and ozone play in the warming, snow melt and rains.

It is now understood that, for best results the short lived air pollutants like particulate matter must also be curbed to reduce the warming spikes while taking stringent action to curb CO₂ for the overall impact.

The particulate matter consists of black carbon that is largely a product of incomplete combustion and comes from all combustion processes, all dust generating activities and secondary particulates. These last up to minutes, hours and even one week or little more in the atmosphere depending on the combustion process and size. But as long as they exist, they can absorb heat and warm up the surrounding atmosphere; accelerate snow melt and disturb rain patterns. But this does not mean that this science of warming impact of local air pollution shifts the blame of causing global warming and climate change now from the developed world who have cleaned up their to the developing world that are still much lower on the technology ladder and responsible for high local pollution. The magnitude of CO₂ emissions from fossil fuel burning in the developed world still remains the most important reason for climate change.

The latest IPCC report AR5 has taken note of the recent research and is more explicit in its discussion on black carbon from its previous report. For instance, if global warming potential of CO₂ over 100 years is 1, that of black carbon is estimated to be 900. Though this comparison has limitations due to their different residence life in the air, there are impacts.

Black carbon can also accelerate ice-melt when they settle on snow. The bright snow surface reflect a high amount of solar energy back into space. But black carbon absorbs substantial fraction of this energy and re-emits it as heat. The Arctic and the Himalayas are therefore vulnerable. Black carbon is also reduces sunlight that reaches sunlight that

reaches the surface and that is reflected back to the space. Black Carbon may change precipitation and surface visibility.

According to climate science, there are good and bad particles depending on their cooling and warming impacts. All particles do not warm. Some have cooling effect as well. The organic carbon and sulphate that come largely from open biomass burning and cook stoves of the poor have cooling effect as they are light reflecting. These have much higher proportion of cooling particles. But black carbon that comes mostly from diesel vehicles, black kilns etc is light absorbing. Share of cooling and warming particle determines the net positive or net negative impact of different pollution sources.

In fact, the cooling particles from the poor people's technology and cooling stoves in developing countries are masking a lot the committed warming in the developed world.

However, from public health perspective, both cooling and warming particles must be eliminated as they harm our health. Measuring the health effects from climate change can only be every approximate. Nevertheless, a WHO assessment, taking into account only a subset of the possible health impacts, and assuming continued economic growth and health progress, concluded that climate change is expected to cause approximately 250000 additional deaths per year between 2030 and 2050; 38000 due to heat exposure in elderly people, 48000 due diarrhea, 60000 due to malaria, and 95000 due to childhood under nutrition.

WHO Response

Many policies and individual choices have that potential to reduce greenhouse gas emission and produce major health co-benefits. For example, cleaner energy systems. And promoting the safe use of public transportation

and active movement-such cycling or walking as alternatives to using private vehicles-could reduce carbon emissions, and cut the burden of household air pollution, which causes some 4.3 million deaths per year, and ambient air pollution, which cause about 3.7 million deaths every year.

In 2015, the WHO Executive Board endorsed a new York plan on climate change and health. This includes:

- Partnerships: to coordinate with partner agencies within the UN system, and ensure the health is properly represented in the climate change agenda.
- Awareness raising: to provide and disseminate information on the threats that climate change presents to human health and opportunities to promote health while cutting carbon emission.
- Science and evidence: to coordinate reviews of the scientific evidence on the links between climate change and health, and develop a global research agenda.

Such an approaches can help India to maximize the larger welfare. This will help to take early and effective action in all sectors of pollution, enable leapfrogging to clean technology and to the alternatives. This would also have to be enabled by local and global support for action to improve access to clean technologies and disseminate knowledge on best practices.

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