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The Bad Science Choking India

By: Bhargav Krishna,Anand Krishnan,Karthik Ganesan,Poornima Prabhakaran,Sagnik Dey

Air pollution levels worsen each year, yet action is stymied by the government maintaining there is no correlation with deaths and diseases. As India embarks on a decadal review of its air quality standards, this distortion of science needs to be checked.

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Air pollution is the second largest risk factor for ill-health in India, only behind malnutrition. Since 1990, death rates from ambient air pollution — particulate matter and ozone — have more than doubled, with both household and ambient air pollution contributing to almost 1.7 million deaths in 2019 (Pandey et al. 2020). The economic losses caused by this health burden amounted to $36.8 billion or 1.36% of India's GDP that year. India has several of the most polluted cities on the planet, with annual exposures across most of north India exceeding global and domestic standards. (WHO 2017).

Yet, the Indian government's response to these numbers has been to call into question their credibility and to claim that "there is no conclusive data to establish direct correlation of death/disease exclusively due to air pollution" (MoEFCC 2021). Air pollution levels continue to worsen with each passing year, yet action is stymied by those calling for a larger base of "local evidence." This prevarication has serious implications for India's ambitions of improving its air quality to levels considered breathable.

More importantly, as India embarks on its decadal review of air quality standards, these distortions of science can have repercussions that stay with us for a generation.

Distorting science

Estimates of death and disability from air pollution in India are the result of extensive collaborations between dozens of reputed epidemiologists, physicians, atmospheric scientists, and statisticians. They are led by by the Indian Council of Medical Research, Public Health Foundation of India, and the Institute of Health Metrics and Evaluation. Comparable studies have also been carried out in Indian Institute of Technology Bombay, the Health Effects Institute in Boston, the University of Chicago, and the University of Texas.

> The [government claims] that there is little to no Indian evidence on the harmful effects of air pollution. To the contrary, there is considerable local evidence.

The government and its associated institutions consistently maintain that such large-scale modelled estimates of the health impacts are unreliable as they are based on a pool of global studies, are prone to bias, and are unconnected to Indian conditions. They also place untenable conditions of causality on the link between air pollution and ill health.

These arguments are undergirded by a series of incorrect claims.

The first is the claim that evidence from global data cannot be generalised across geographies to estimate national impacts, since most countries have much lower exposures than India does.

However, estimates such as the Global Burden of Disease (GBD) are derived from data collated from hundreds of studies across the world that estimate the effects of air pollution on various health outcomes (Burnett et al. 2014) and represent a range of exposures to air pollution. Since 2019, these estimates have included data from China and India, not just from countries in North America and Western Europe (where the bulk of the work on this subject has been carried out). Through the inclusion of these studies, the GBD collaborators are able to understand health impacts across a continuum of exposures, from the lowest to highest, thereby aiding in the extrapolation of estimates for varied regions of the world.

The second claim made is that there is something particularly unique about Indians that makes us able to adapt to higher exposures to air pollution.

This is a particularly harmful claim, especially when physicians too engage in such misconceptions. The reality is that Indian cardio-respiratory systems are in no way immune to the harmful effects experienced by others. Studies conducted in China, which has seen similar exposure levels as in major Indian cities, have shown similar results to our own, eliminating any potential variance in our ability to adapt to air pollution (Hystad et al. 2020). In fact, given early childhood deficiencies, genetic predispositions, social stratification, poor access to healthcare, interactions with other environmental pollutants and their associated epigenetic effects, Indians — especially in rural or industrial areas and urban slums — might be *more* vulnerable to air pollution insults.

As Asher Ghertner (2019) has shown, the argument for a "difference" in Indian lungs and physiology originated as a justification for the segregation of Indian and European populations in colonial India. It is insidious that the same claim has been used in recent years as a rationale for inaction on air pollution. Ghertner notes that in the 2016 case of *Vardhman Kaushik vs. Union of India*, before the National Green Tribunal, the government submitted that global benchmarks for pollution are not applicable in India due to the inherently polluted nature of the Indo-Gangetic plain. More recently, a policy brief published by the National Institute of Advanced Studies (NIAS) boldly claimed that due to evolutionary processes, populations in India have become immune to more polluted conditions. The brief, authored by a geologist, mining engineer, and atmospheric scientist, respectively— all eminently qualified in their own fields but none having any acquaintance with epidemiology — makes a mockery of evolutionary biology as much as it does of common sense.

> Epidemiology [...] has guided action against serious risk factors such as tobacco smoking, poor nutrition, or water contamination. Air pollution must be treated in the same way.

The third claim is that there is little to no Indian evidence on the harmful effects of air pollution.

To the contrary, there is considerable local evidence. As early as the 1950s, a study by S. I. Padmavati, a renowned cardiologist, noted high exposure to air pollution as a potential causative agent for high levels of pulmonary heart disease amongst low-income households of Delhi (Padmavati and Pathak 1959). Physicians continued to describe, in major national medical journals, the harmful effects of air pollution through the 1960s, 1970s and 1980s.

Over the last two decades, Indian scientists across institutions and disciplines have utilised complex methodological schema to establish the impact of air pollution exposure on a range of health outcomes. Exposure to poor air quality has been associated with premature mortality amongst young children and the elderly across various cities (Singh et al. 2019; Krishna et al. 2021), increased blood pressure and incident hypertension (Prabhakaran et al. 2020), reduced lung function and asthma (Maji, Ghosh, and Ahmed 2018), premature births and low birth weight (deSouza et al. 2022; Liao et al. 2022), among others. A number of these studies have relied on field measurements of these health outcomes among thousands of study participants, thereby obviating the primary concern with studies that extrapolate based on modelled estimates.

Some of these studies have also been documented in the union health ministry's germinal report of 2016, which noted the pervasive and long-lasting impacts of air pollution exposure (Balakrishnan et al. 2015). There are other repositories of Indian studies on air pollution documented and hosted by the health ministry in subsequent years, besides another by the National Environmental Engineering Research Institute of the Council of Scientific and Industrial Research.

The final claim against linking air quality and mortality rests on a red herring: that any individual death can be directly attributed to air pollution as the causative agent. This is impossible, for the simple reason that air pollution is not a dysfunction of the human body, and no death can be labelled as solely due to air pollution. Diseases are by their very nature multi-factorial, the product of behavioural, environmental, genetic, and other forms of risk factors. Epidemiology allows us to understand what proportion of any disease in a population is due to each of these risks. Such work has guided action against serious risk factors such as tobacco smoking, poor nutrition, or water contamination. Air pollution must be treated in the same way.

Air pollution presents unique scientific challenges in terms of its ubiquitous and long-term nature of exposure. But this does not negate the evidence generated over decades. The gaps in our understanding of how air pollution affects health only highlight the need for greater investment in generating indigenous capacity to carry out such work. For instance, there are no studies currently available in India that catalogue the differential impacts of the various components of particulate matter. Similarly, there is also a case to be made for expanding greatly the several existing long-term cohort studies that aid us in increasing our understanding of the health effects of air pollution across the life course. An additional aid in refining policy would also be studies that explicitly catalogue the health effects

of specific air pollution interventions.

Even as we endeavour to plug the gaps, we must use best practices to draw inferences from the science that exists, abiding by the time-honoured principle that the absence of evidence is not evidence of absence.

Factoring health

The hollowness of the government's arguments is especially salient in light of India's proposed review of its air quality standards.

Every decade or so, India revises its National Ambient Air Quality Standards (NAAQS), which define what constitutes clean and safe air to breathe across the country. The last time it did so was in 2009. The proposed revisions – announced before the WHO in September released its own revised and more stringent guidelines – are meant to reflect the burgeoning local evidence base since the previous iteration. They are also meant to take stock of the growing global consensus that air quality norms must reflect the kind of development pathway nations choose to embark on.

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One fundamental principle that needs to be adhered to while revising the air quality standards is to integrate a health framework into environmental policymaking. This would mean focusing more on sources that are closest to people, like household cookstove smoke and transportation, rather than just those that contribute more broadly to ambient air pollution loading. An enhanced focus on mandated health impact assessment studies before granting environmental clearances to industries can strengthen the evidence base for environmental policymaking and the setting of appropriate emission standards.

This would also mean recognising that environmental policy exists for the fundamental purpose of protecting public health. At present though, there is a distinct absence of health science factoring in environmental decision-making in any substantial way, with little representation from the health sector in expert committees.

If at all a health representative is included, it is most likely to be a physician but physicians in India lack the cognisance necessary to be effective conduits for patients or to advocate for broader society on air pollution. Studies have shown that Indian physicians are mostly unaware of the systemic and cascading impacts that air pollution can trigger, beyond an intuitive understanding of the impact on the lungs. Physicians are also largely untrained in epidemiology or statistics needed to conduct large scale studies to inform air pollution policy, as suggested by the NIAS brief. We must build the capacity of physicians to effectively deliver on what is a public health mandate, rather than a medical mandate, by supplementing the medical curriculum with relevant information on environmental risk factors, as well as by disseminating the latest research amongst the broader medical community.

A broader approach

Air pollution came into public focus in India in the late 1980s and early 1990s, primarily through public interest litigations filed by the environmental lawyer M.C. Mehta in the Supreme Court. The eponymous case continues to this day, with the court folding into its ambit several issues related to air pollution litigation. The court's directives have led to significant policy shifts, including the transition of public transport in Delhi from diesel to CNG in the early 2000s.

However, these efforts have been piecemeal in their implementation, and the following two decades have witnessed a significant deterioration in India's and the capital's air quality.

> Rooting our environmental policymaking including and beyond air pollution, on foundations of science, rationality, inclusivity and interdisciplinarity, is essential as India rebuilds and envisions a radically different development pathway in the aftermath of the Covid-19 pandemic.

The nation's air quality usually become a subject of public debate only around winter when Delhi's air quality reaches its nadir. A crescendo of news reports, parliamentary questions and TV debates repeats familiar, often fallacious arguments. Ultimately, the discourse settles around the specific sources that contribute to extreme exposures in winter and, the immediate sticking plaster solutions needed to fix this.

The abundance of irrational solutions employed to fight Delhi's air pollution crisis should serve as a warning against a piecemeal approach that repudiates basic science. We have spent crores already, constructing ineffective smog towers, re-routing truck traffic around cities, and outsourcing pollution from thermal power plants to those who are farther away and less fortunate.

Rooting our environmental policymaking including and beyond air pollution, on foundations of science, rationality, inclusivity and interdisciplinarity, is essential as India rebuilds and envisions a radically different development pathway in the aftermath of the Covid-19 pandemic. The NAAQS review and the approach to this work can serve as a template for better and more informed policymaking structures, undergirded by a framework that is transparent, replicable, and based in science.

The moves made under the National Clean Air Programme to establish a National Knowledge Network (NKN) of technical experts to aid cities around the country in tackling their air pollution problems is a worthy first step. But the platform needs to embody an inclusive spirit needed to effectively translate knowledge to action by inviting into its fold individuals of differing thematic expertise beyond environmental engineers.

> A complex problem like air pollution that influences and is influenced by economic, social, environmental, and economic factors must receive the multi-disciplinary attention it requires.

Correcting this narrowness of expertise also feeds into what is now a global best practice: the idea that decision-making structures need to be supported by a broad-based, multi-disciplinary panel of scientific expertise comprising epidemiologists, atmospheric scientists, environmental engineers, public policy experts, and social scientists. A complex problem like air pollution that influences and is influenced by economic, social, environmental, and economic factors must receive the multi-disciplinary attention it requires.

Strengthening institutions

Revamping our decision-making structures would also entail strengthening the capacity of the institutions tasked with developing these policies. At a time when regulatory norms globally are moving away from purely focusing on enforcing stack emissions standards towards a more holistic perspective that looks at the carrying capacity of ecosystems or airsheds, our regulatory bodies are woefully underequipped.

Several reports over the years, including by parliamentary standing committees, have noted the dearth of technical capacity within pollution control boards (PCBs), either due to a lack of funding or lack of trained manpower. These capacity constraints create bottlenecks and lead to a narrowing of focus to a smaller set of tasks that can be executed by existing staff. This hampers progress at both the state and the national level as the remit of our PCBs goes far beyond just issuing consents to operate or conducting basic monitoring. We need to both urgently hire new staff and train existing staff to maximise monitoring capacity by blending modelled and measured data.

Our fight against air pollution will take several years if not decades, not least because it involves consideration of trade-offs that impact health, economic growth, and most importantly, livelihood. It will also require strategic planning and foresight founded in basic science and evidence-informed policy.

Continuing in denial will only ensure that we persist with the status quo, putting in danger the lives of the vulnerable among us. It is vital that our executive and regulatory institutions eschew spurious rationale and recognise the fundamental need to embed science in environmental policymaking.

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