When the Air Becomes Poisonous: Air Pollution and Pakistan's Public Health Fight against a Silent Killer

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Abstract:

Air pollution has emerged as one of the most pressing environmental and public health challenges of the 21st century, disproportionately affecting low- and middle-income countries. In Pakistan, rapid industrialization, urban sprawl, and weak regulatory enforcement have culminated in dangerously high pollution levels, particularly in major cities like Lahore, Karachi, and Peshawar. With over 135,000 premature deaths annually and a reduction in life expectancy by nearly four years, the crisis transcends environmental degradation—it is a national health emergency.

Cite: SH Munawar, Memon S, Soomro MH. When the Air Becomes Poisonous: Air Pollution and Pakistan's Public Health Fight against a Silent Killer. J Muhammad Med Coll. 2025; 16 (1). pp 1-3.

Globally, the air pollution is an increasing environmental and public health issue of the 21st century.[1] The ongoing rapid industrialization, urbanization, reliance on fossil fuels and limited regulatory frameworks in the developing world are leading to higher levels of pollution in the environment.[2] As per the World Health Organization (WHO), "99% of the global population is breathing air which exceeds the safe pollution limits, with low and middle-income countries bearing 89% of pollution-related deaths".[3] As a consequence of poor air quality, the inequalities are exacerbated, thereby affecting the marginalized communities disproportionately who are already faced with limited accessibility to healthcare and clean energy. According to a 2021 study, the air pollution is severely affecting the Asian continent leading to higher particulate matter concentrations as reported in South, South East, and West Asia, respectively.[1] The most polluted countries in South Asia and the world include; India, Bangladesh and Pakistan.[1]

Millions of people in Pakistan are suffering due to air pollution, which has evolved from a necessity for survival to a pervasive and silent threat.[4] Currently, larger cities such as; Lahore, Karachi and Peshawar are ranked among the most polluted cities globally, and their skies often remain shrouded in a toxic haze.[4] Children (the future of any nation) in those cities exhibit asthma rates to the tune of 40% higher than those in rural areas! For Pakistan, this situation should be considered no less than an emerging national crisis; it is not just an environmental issue but very much a public health problem. Data indicates an overwhelming premature deaths of over 135,000 individuals annually; the air pollution problem can also reduce the average life expectancy by around 3.8 to 3.9 years.[5]

Air pollution is one of the leading causes of aggravation in respiratory diseases including asthma, chronic obstructive pulmonary disease, and acute respiratory infections, lung cancer, eye and throat problems, allergies, adverse neonatal outcomes. Air pollution can also lead to cognitive decline and cardiovascular diseases (ischemic heart disease and stroke).[6] The individuals already suffering from various health conditions including children, the elderly, and pregnant women are more prone to air pollution related health issues and complications. UNICEF (2024) report highlights that over 11 million children under the age of five years, in just one province- Punjab, are exposed to toxic air, resulting in increased hospitalizations and long-term health implications. The main factors responsible for air pollution include; industrial and vehicular emissions, burning of waste and biomass, and brick kilns. Moreover, the lack of robust air quality monitoring and enforcement of environmental regulations, further aggravate the problem.[7] In addition, the aging vehicles spewing black carbon in the environment, unregulated factories releasing sulfur dioxide, and seasonal crop residue burning, blanketing the entire regions in smog [7,8]; are the problems that can be tackled relatively easily. Meanwhile, millions of households in rural areas are faced with indoor air pollution because they still rely mainly on burning solid fuels like; wood and dung for cooking and heating. This creates a suffocating environment which is especially hazardous for women and children.[9,10] Household air pollution alone contributes to millions of premature deaths globally and a significant proportion is within Pakistan.[1, 4] The health impact of air pollution is not limited to only the lungs, but the "fine particulate matter (i.e., PM2.5, PM10, etc.), Sulphur dioxide (SO2), nitrogen dioxide (NO2), and ozone (O3), penetrate deep into the bloodstream, causing inflammation, heart disease, and even neurological damage".[11,12]

There are several underlying causes of this situation in Pakistan which are more than the environmental mismanagement, but the so-called "policy paralysis", weak governance, and vested industrial interests, and limited public accountability, play the havoc. For example, around 90% of brick kilns continue using outdated, polluting technologies despite their known health and environmental harms.[13] Considering above challenges, some community-led initiatives have been started using low-cost air quality sensors to track pollution and raise awareness among the local population; and some pilot projects include the installation of smog towers and experiments with artificial rain to mitigate the air pollution in hotspots.[14] The government's Electric Vehicle Policy, although slow in implementation, aims to curb emissions by promoting electric bikes, rickshaws and cars. The programs funded by World Bank are helping

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Received: 02.06.2025 - Revised: 25.08.2025
Accepted: 30.08.2025 - Published online: 05.10.2025

factories to use cleaner technologies, while the universities are collaborating with local governments and NGOs to conduct research for developing practical solutions. However, these efforts are insufficient to handle the situation and are often faced with difficulties in coordination, political support, and sustained funding.

To really solve this crisis, Pakistan needs a well coordinated plan. Immediate measures such as health camps during smog seasons, subsidies for farmers to adopt non-burning methods of residue disposal, and provision of clean cookstoves can reduce acute suffering.[15] In the long term, sweeping reforms are utmost important to take which include transitioning industries and brick kilns to cleaner fuels, expanding and modernizing electric public transport networks, and incentivizing renewable energy sources like solar and wind.[16] Urban planning must integrate more green spaces and enforce stricter controls on construction-related dust. Waste management systems need a complete overhauling with properly organized system of waste collection, processing with recycling infrastructure, coupled with education of stakeholders, and perhaps a ban on the open burning of different wastes. In the agricultural sector, sustainable practices should replace stubble burning and excessive fertilizer and pesticide use. Environmental education must be ramped up through nationwide campaigns involving influencers, religious leaders, and school programs for teachers as well as for children to dispel myths and foster behavioral change. Air quality standards must be updated in line with global benchmarks and strictly enforced. The National Clean Air Policy[17] should be revitalized with clear, measurable targets and accountability mechanisms. Investment in real-time air quality monitoring infrastructure should be scaled up, with transparent data sharing to build public trust and enable informed decision-making. Regional cooperation is also key requirement, particularly in addressing transboundary pollution. Collaborative frameworks with neighboring countries can enhance data sharing, harmonize air quality standards, and manage shared environmental risks. Civil society, academia, and the private sector must be engaged as equal partners in crafting and implementing solutions.

In conclusion, Pakistan's air pollution crisis is not just a technical problem, it is a moral and social issue as well. It reflects a society's grappling with the costs of unchecked industrialization, weak governance, and environmental injustice. Yet the solutions are within reach, but require not only the technological fixes but a fundamental reimagining of national priorities, placing health, sustainability, and equity above the short-term gains. Pakistan's ability to recover its right to clean air will depend on how determined its population and authorities are to take action as smog-choked skies try the fortitude of millions; hence the education and awareness among the population would help immensely. The alternative is unthinkable: a future, where breathing itself becomes hazardous. To tackle this invisible yet a serious issue, requires immediate bold actions, and innovative solutions. Furthermore, it is also important to advance the renewable energy, increase green spaces, and reduce dependency on fossil fuels to better protect the physical and mental well-being of Pakistan's future generations.

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