# The Hidden Crises of Pollution Undermining Public Health

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## Abstract

Presently, pollution is a global evil that continues to raise healthcare costs, decrease productivity and affect the environment. Pollution has intensified due to slow responses to it and because regulations are weak, enforcement is poor, and corporations continue to greenwash. International efforts, like the Paris Agreement, hold out hope, but they are riddled with problems like unequal commitments and funding gaps. London's Clean Air Act is a case of effective pollution control by way of stronger legislation, technological innovation and community-driven action. Raising awareness, monitoring of diseases and advocating for better policies are the roles played by the healthcare system. It will take a coordinated response from governments, businesses and communities to shrink the volume of pollution, cut the cost of healthcare and live up to the best we believe about our future. Healthcare systems can utilize healthcare environment data to proactively track and study the causal links and effects of adverse health impacts from pollution, and the data can be useful for improving public policies.

**Keywords:** Pollution, Global issue, Healthcare system, Healthcare regulations, Technological inventions

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## Introduction

Pollution is generally referred to as the deliberate release of hazardous materials or goods into the atmosphere, which severely disrupts natural processes and endangers the safety of humans (Ajibade et al., 2021). It takes multiple shapes, notably air, water, soil, and pollution from noise. Air pollution is primarily caused by industrial pollutants, exhaust from cars, and the combustion of fossil fuels, which hurt lung health and general wellness (Balabadra, 2022). Water pollution, frequently generated by industrial emissions and crop residue, can contaminate water for consumption sources, causing serious health dangers (Lu et al., 2015). Soil pollution, caused by unsafe waste dumping and chemical leaks, jeopardizes the security of food and crop production (Raimi et al., 2022). Noise pollution, which is often disregarded, has been connected to stress-related symptoms diseases and sleep disruptions, demonstrating pollution's complex and complicated nature (Nwe, 2019).

### The Association affects Pollution and the Health of Society

Pollution is a significant hazard to human well-being, with direct and indirect consequences that can result in various chronic diseases and severe health emergencies (Corvalan et al., 2005). Direct effects stretch to breathing issues caused by inhaling dirty air, whereas unforeseen consequences might result from filthy water sources, resulting in illnesses spread by water (Tulchinsky & Varavikova, 2014). Documented examples reveal the damaging results of pollution on the general public (Doğru et al., 2016). For instance, the Great Smog of London in 1952 highlighted the risks of air pollution by causing thousands of premature deaths. Figure 1 shows the list of sources of Environmental Pollution Depicting Percentage. Parallel to this, Minamata's condition, which was brought on by mercury poisoning in Japan, caused significant brain damage in the populations around her, underscoring the serious implications of chemical overexposure. The 1986 Chernobyl accident demonstrates how pollution and environmental catastrophes can lead to overall health issues, including an increased risk of carcinoma of the thyroid and mental disorders in affected communities. These noteworthy events highlight the significance of addressing pollution as a detrimental health aspect (Fuller et al., 2022).

### The Underlying Roots of the Problem

In fact, of its major implications, pollution is deliberately ignored in public debate (Kelly & Fussell, 2015). This underestimating is imputable, in part, due to the crisis's incremental and constant consequences, which may make it appear "invisible" to people (Haarløv, 2024). Unlike acute medical emergencies, the effects of pollution frequently occur over time, resulting in ongoing medical issues that are not directly connected to environmental sources (Manisalidis et al., 2020). Moreover, news coverage tends to rank more urgent or outwardly magnificent topics, evolve in underreporting and inadequate public policy responses to pollution-related illnesses (Kek, 2020).

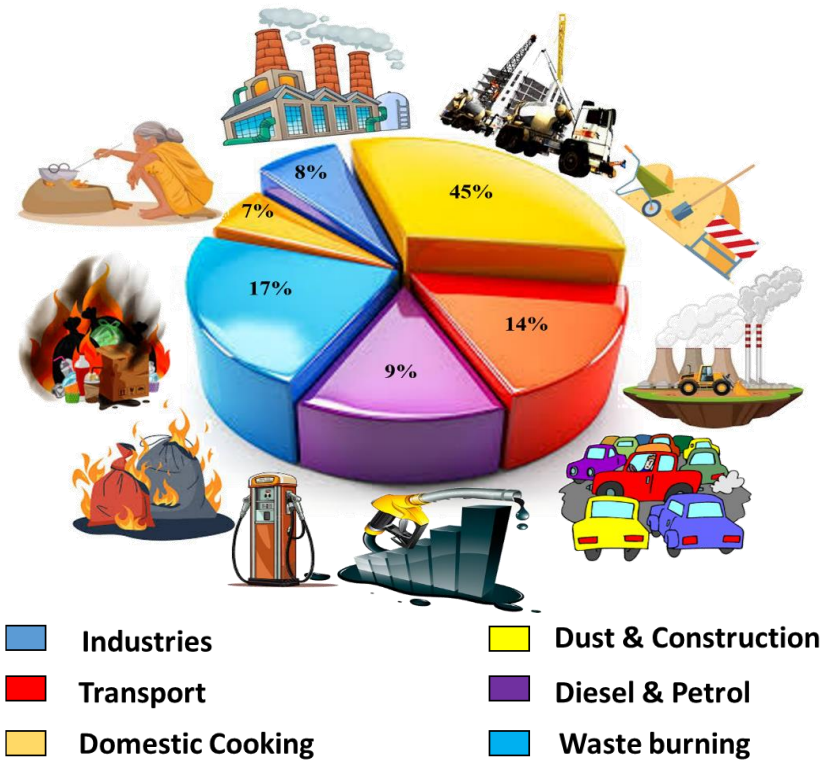


**Fig. 1:** Sources of Environmental Pollution Depicting Percentage

**Types of Pollution and Their Health Effects**

**Air Pollution**

Air pollution is a serious global threat from various sources, including industrial byproducts, car emissions, and domestic contaminants (Munsif et al., 2021). Manufacturing processes produce a significant amount of aerosols such as sulfur dioxide, nitrogen oxides, and particles, which can remain in the atmosphere for a long period (Liu et al., 2021). Another major origin is vehicle exhaust, particularly from vehicles and trucks, which releases harmful elements such as carbon monoxide and reactive organic substances (Amarachi et al., 2016). Moreover, the handling of household goods such as paints, cleansers, and tobacco smoke can raise air quality in homes by increasing levels of detrimental particles and gases in compact areas (Seguel et al., 2017). cleaners

**Health Effects of Air Pollution**

Air pollution has wide-ranging and complex health impacts, particularly on the health of the heart and lungs (Sharma et al., 2013). Long-term asbestos exposure can cause respiratory issues like asthma and chronic obstructive lung disease (COPD), moreover a greater probability of coronary artery disease and stroke (Jiang et al., 2016). According to an investigation, air pollution is linked to cancer, particularly lung disease, because of the cancer-causing substances present in contaminated air (Pourvakhshoori et al., 2020). Children who are exposed to airborne contaminants may deal with slow sup in growth and impaired pulmonary function as shown in Figure 2, Additionally older people might confront health problems and an increased chance of hospitalization. Urban, inhabitants and those who live near industrial zones are more prone to respiratory disorders caused by air pollution. In extremely polluted places like New Delhi and Beijing, the prevalence of respiratory disorders has soared, with a large increase in admissions to hospitals for asthma and other lung ailments.

**Effect of Airborne Polluting Substances on Breathing System**

Air pollution is a significant risk contributor to breathing-related conditions, which impact thousands of people globally (Rakhimov, 2014). The most frequent contaminants that because respiratory disorders are fine particles (PM2.5 and PM10), nitrogen oxides (NOx), sulfur dioxide ($SO_2$), and atmospheric ozone ($O_3$). irritants which are frequently produced by manufacturing processes, cars, and nuclear plants, enter the airways and induce irritation, decreased respiration, and a higher susceptibility to illnesses (Meo et al., 2024). Severe exposure to tiny particles (PM2.5) has been linked to the development of asthma, chronic obstructive pulmonary disease (COPD), and lung tumors (Li et al., 2018).

**Water Pollution:**

Water pollution is a severe environmental hazard threatening human and ecosystem health (Naiman & Dudgeon, 2011). Industrial pollution discharge, soil erosion, and poor sanitation (Plessis & Plessis, 2019) are caused by the factors making them. The waterways of rivers, lakes and oceans are often indiscriminately 'polluted' by factories dumping heavy metals, toxic substances and biological material into waterways. For example, companies can launch wastewater with dangerous material like arsenic, cadmium, and lead contained inside, which can become deposited in aquatic habitats and do damage to marine species and people. Improper fertilizer and pesticide use due to agricultural operations release nutrients and eutrophicans (Tiwari & Pal, 2022).

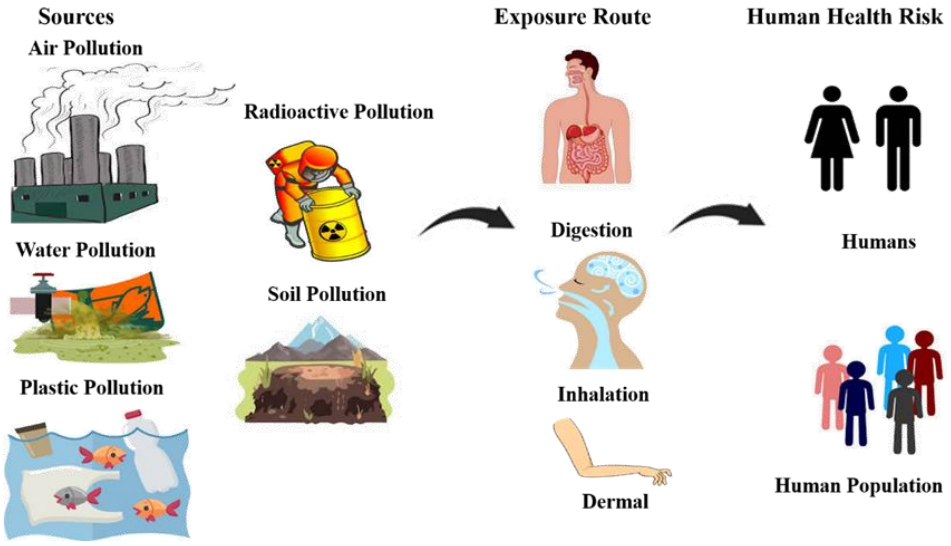


**Fig. 2:** The Effects of Pollution on Health

This technique allows algae to grow in the dams it depletes the supply of oxygen and it produces poisons that affect our aquatic ecosystem and humans (Paerl et al., 2001). Lots of people across numerous emerging nations depend on unclean water supplies, increasing their chance of infection with dangerous bacteria (Kristanti et al., 2022). In Bangladesh, the extensive presence of arsenic in groundwater has triggered an epidemic of health issues, with millions experiencing symptoms of arsenicosis, a chronic illness triggered by exposure to arsenic that can result in skin sores and malignancies.

**Health Effects of Water Pollution**

Water contamination has a broad range of short- and long-term heal issues (Villanueva et al., 2014). Water-borne illnesses including infections such as cholera, dysentery, and hepatitis A are directly connected to polluted water supplies and pose an impending risk to the general community, especially in underdeveloped countries (Bartram et al., 2015). These disorders can cause serious gastrointestinal difficulties such as diarrhea, vomiting, and water loss, that can be life-threatening, especially in kids and the elderly (Dumic et al., 2019). Moreover, chronic rooting out to hazardous substances present in polluted water, such as lead, mercury, and arsenic, may cause major health consequences, including brain damage, delayed growth in children, and an increased risk of cancer (Sharma & Kumar, 2019). For instance, long-term usage of lead can cause cognitive impairment and behavioral abnormalities in youngsters, but arsenic is too connected to cutaneous illnesses and tumors in the bladder (Mitra et al., 2017).

**Control Measures of Water Pollution**

The long-lasting consequences of water degradation underscores the need for suitable controls to protect the cleanliness of water and the wellness of all people (Li & Wu, 2019). The general public educational events focus on the importance of safe water and good hygiene and are additionally able to control waterborne illnesses and encourage residents to participate in water-saving measures (Kumar et al., 2023). Moreover, present-day innovations, such as advanced filtering techniques and biological remediation methods, can help reduce water pollution and restore degraded water bodies (Patowary et al., 2023).

**Soil Pollution**

Soil contamination is a serious environmental concern resulting from factors, including excessive pesticide use, commercial waste disposal, and urbanization (Bhatia et al., 2015). Agricultural systems usually depend heavily on chemical fertilizers and pesticides to boost productivity of crops, leading to the buildup of toxic substances in soil (Sharma & Singhvi, 2017). These chemicals can harm soil microorganisms eliminate useful species, and diminish the biodiversity of soils gradually (Baweja et al., 2020). Manufacturing operations contribute to soil contamination by releasing dangerous materials, heavy metals, and chemicals, which are frequently the result of incorrect disposal or accidents.

**Health Implications of Soil Pollution**

There are two health implications of soil pollution. Contamination with dirt poses risk to people, particularly by poisoning food crops (Steffan et al., 2018). It's not good for you when plants absorb toxicity from the soil, and harmful compounds enter the food chain. Cadmium, lead and mercury, all are heavy metals and can have serious consequences concerning health including kidney failure, delay in growth and many types of cancer (Balali-Mood et al., 2021). With exposure to the dirty dust for a long time, the organisms can develop reproductive issues or cause hormone disorders (Canipari et al., 2020).

**Noise Pollution**

Noise pollution is an often overlooked but major environmental concern, especially in cities (Hemmat et al., 2023). Traffic, industrial activity, development, and leisure activities all contribute to noise pollution (Mohamed et al., 2021). Urbanization has increased population density and automobile traffic, resulting in higher noise levels in cities (Salomons & Pont, 2012). Constant noise from bulky equipment, building

locations, and congested streets upsets communities and reduces residents' quality of life. Furthermore, leisure pursuits such as performances and athletic competitions can trigger localized noise pollution, causing additional disturbance for neighboring neighbors (Plontke & Zenner, 2004).

**Unjust Effects on Dependent Societies**

**Socioeconomic Differences in Pollution Sensitivity**

Socioeconomic gaps have significant effects on pollution being exposed, with marginalized people paying the disproportionate burden (Mathiarasan & Hüls, 2021). In many new towns illegal communities are located near industrial areas with little or no oversight, exposing inhabitants to harmful chemicals and rubbish. Moreover, these impoverished groups frequently lack possession of vital necessities such as freshwater, cleanliness, and health (Forastiere et al., 2007). Inadequate building increases pollution sensitivity; for instance, numerous lower-income individuals drink and shower in dirty water bodies, rendering them more prone to illness caused by water (Quaye, 2008). Moreover, an absence of proper restrooms contributes to ecological degradation and the spread of disease (Bartram et al., 2015). Finding medical care may prove challenging in less developed regions, preventing people from seeking immediate care for pollution-related ailments (Adigun & Odeleye, 2025). The resultant, socioeconomic difference in contamination exposure buildup a downward spiral in which marginalized human tolerates greater damages to their wellbeing as well as missing the capability to solve these problems accordingly (Flowers et al., 2023).

**Effect on Kids and Expecting Women**

Pollution imposes major risks to poor people, particularly young kids and pregnant women, who are more vulnerable to its detrimental effects (Landrigan et al., 2019). Air pollution, in particular, is believed to be linked to poor childbirth outcomes such as early deliveries, premature births, and difficulties with growth (Ritz & Wilhelm, 2008). Being exposed to tiny particulate matter (PM2.5) along with additional airborne pollutants can impair the growth of babies and raise the chance of pregnancy problems (Johnson et al., 2020). Pregnant women who reside in unhealthy environments may experience increased anxiety and physical problems, thereby jeopardizing their entire health and that of the baby they are carrying (Naidu & Nqila, 2013).The consequences of air pollution for children are above obvious health consequences (Cohen et al., 2005). Children in high-pollution areas suffer more from asthma, allergies, or other chronic conditions, which affect children's physical development and their ability to learn (Bhattacharjee et al., 2024). Pollution leaves a lasting scar on child development, extending the cycle of poverty by keeping children.

**Global South Versus Global North**

Pollution loads breakdown reveal great disparities between industrialization and developing countries, and the Global South often has been asked to bear an unfair share of the environmental burden (Reese & Westra, 2012). India, China and other Sub Saharan African countries have faced a surge of pollution as a result of rapid industrialization, urbanization, industrialization and low environmental restrictions (Afriyie et al., 2023). This economic growth often sacrifices such an ecosystem in these areas as industries pour toxins into air, water and soil with no control (Zhao et al., 2022). Research shows that degradation in these areas has catastrophic consequences such as higher levels of dust in the air in Delhi and China, which is also a serious threat to the population (Sharma & Kumar, 2019).

On the other hand, countries in the Global North have wealthier health care systems and better environmental regulations, and can therefore better adequately control the effects of pollution (Haines et al., 2007). nevertheless, this does not mean that these countries are pollution-free; instead, they might export pollution by methods like garbage disposal or outsourcing high-pollution businesses to less regulated countries (Dave et al., 2022). The disparate allocation of pollution expenses poses moral questions regarding sustainability and developed countries' responsibilities to promote sustainable development in the Global South (Brown, et al., 2014). These inequities can be addressed and health can be improved for all through the conduct of collaborative activities that prioritise environmentally safe procedures, transfer of technology, and safe guarding the environment (Friel et al., 2015).

**Pollution is a Cause of Neighborhoods Worldwide Medical Inequality**

Environmental injustice refers to the idea that low-income people, and especially racial and ethnic minorities, tend toward living in polluted locations (Sibley et al., 2024). In addition, these neighborhoods are near industrial operations, landfills or large highways where hazardous chemicals are prevalent (Elliott & Frickel, 2013). For example, in the United States African Americans and Latinos are more likely to live near ports and industrial sites, and have higher rates of asthma, respiratory disease, and cancer (Johnson et al., 2014). Poverty communities in developing countries often inhabit informal communities with no access to clean water or sanitation and are therefore exposed to further environmental threats (Adams et al., 2020). But the impact of pollution is not distributed unevenly based only on geography, but also due to the power of politics (Heynen et al., 2006). Better-resourced communities can facilitate the fight for stronger environmental rules, while poorer communities often lack the political clout to pressure measures to reduce pollution (Faber & McCarthy, 2012). Increasing contamination leads to a growing disparity in quality of life as preexisting social and financial inequalities persist (Fairburn et al., 2019).

**The Financial Effects of Pollution on the General Population**

The medical costs associated with pollution-related disorders reflect the fiscal effect of pollution (Landrigan & Fuller, 2012).

**Missed Productivity and Labor Cost**

Beyond healthcare expenditures, pollution has long and broad-ranging effects, including lost earnings and job issues (Schwartz et al., 2021). Pollution related disorders cause untimely deaths and absences resulting in a loss and decrease in productivity as a whole (Kapoor et al., 2024). Employees experiencing pollution-related health difficulties may take extended sick absences, diminishing their capacity to add value

successfully to their jobs (Hospido et al., 2023). Long-term interaction with pollution can cause chronic health disorders that impair people's ability to work (Naik et al., 2019).

**Environmental and Policy Failures**

**Insufficient legislative systems**

A great obstacle to effective pollution control is imposed by limited regulatory frameworks. In many parts of the world, there are insufficient environmental regulations to protect human health and ecosystem. Commercial expansion along with hunger relief, for example, may lead to limited or ignored environmental restrictions in poorer countries (Padulosi et al. 2013). In industrialized countries, legal loopholes might allow (and they sometimes do) firms to bypass rules and create environmental harm (Gunningham et al. 2004). While lawmakers put together a great deal of legislation relating to the environment, enforcement of these rules is generally ephemeral (Keohane et al., 2019).

**Mitigating Strategies of Pollution Effects on the General Public**

Improving safety for all, reducing pollution (Otero et al., 2018) requires updating environmental law. By requiring higher standards and making sure they're met, you can save lots of pollution. it was possible to limit pollutants of coal burning and automobile exhaust that led to significant improvement of the environment and population well-being (Feng & Fang, 2022). Governments can, by putting forth unambiguous laws and punishments for noncompliance, make the environment of corporations and ensures a clean environment.

In addition, by placing problems in public health into regulatory frameworks, vulnerable populations could be kept safe from adverse health effects linked to pollution (Adanma & Ogunbiyi, 2024).

**The Application of Technology and Advances**

Technology and Innovation improvements are required to deal with pollution and its grave effects on health (Manisalidis et al., 2020). Thus, solar and wind energy as forms of sustainable energy can drastically reduce reliance on the fossil fuels and, in the meantime, lower the emissions of greenhouse gases (Lima et al., 2020). Filtering out pollution and controlling it at its source, (Kwiatkowski et al., 2021) includes a third line of pollution control that involves the use of filters for industrial exhausts, enhanced filtration devices for purifying water and methods used to dispose of waste. Gardening on roofs and tree planting in cities can enhance environmental response (Kumar et al., 2021).

**Community-Based Interventions**

Raising citizens' awareness and grassroots anti-pollution networks are essential through community-based actions (Magno, 2017). Such local initiatives can help a community to fight such changes and make the emitter accountable by educating its residents on the health hazards that pollution brings to their health (Ogwu & Izah, 2024). In analogous initiatives in Delhi, people have come together to demand cleaner air and greater enforcement by local governments. By doing these practices, they can create a feeling of humor and take some part from the responsibility, which has a good chance to improve public health performance and environmental regulation greatly (Frieden, 2010).

**Significance of Medical Facilities**

Identifying and addressing pollution-related health hazards is a crucial job in healthcare systems (Hassan Bhat et al., 2021). Finally, healthcare practitioners can help raise understanding and engagement about potential polluting health risks and can fight for legislation to preserve the environment (Probst-Hensch et al., 2011). Pollution knowledge incorporated into medical education guarantees that future medical professionals comprehend the connections between ecological issues and social well-being results (Hernandez et al., 2003). Additionally, healthcare systems can utilize healthcare environment data to proactively track and study the causal links and effects of adverse health impacts from pollution, and the data can be useful for improving public policies (Eckelman et al., 2020).

**The Pollution-Healthcare Cost Linkage**

Diseases caused by pollution have a catastrophic impact on global health centres (Preker et al., 2016). The fast mounting expense of managing pollution-related disorders such as respiratory disorders, cancer and heart disease is happening in cities with low air quality. This part should examine how chronic interaction with pollutants raises the need for healthcare services, resulting in higher hospitalizations, ER visits, and pharmaceutical expenses. Authorities invest billions of dollars to cure problems that may have been avoided with proper policies regarding the environment (Vig & Kraft, 2012). Furthermore, it would be useful to address expenses that are indirect including reduced revenue from pollution-induced illness, absenteeism, and the lasting financial effects of early mortality (Hunt et al., 2016).

**Appeal to Implementation**

To combat pollution, a broad appeal to action is required (Bain et al., 2016). Legislators must prioritize protecting the environment as their goal, organizations must accept the burden of their environmental impact, and citizens must push for improvement in their areas (Vig & Kraft, 2012). By collaborating to achieve a pollution-free future, humanity can create a better environment and enhance overall health today and in the future (Brack et al., 2019).

**Conclusion**

Addressing pollution as a legal and moral concern highlights the responsibilities of consumers, businesses, and governments to safeguard public safety and the natural world. The obligation to fresh air, water, and soil is important to human rights, and pollution reduction is critical for promoting social equality and fairness. As societies throughout the world deal with the repercussions of pollution, it is critical to recognize the ethical duty to establish a more prosperous, environmentally friendly future for everyone. Legal frameworks that compel industries to

mitigate their environmental footprint, public policies that prioritize health equity, and grassroots activism all play crucial roles in this transformative agenda. It is not just a matter of environmental preservation but a core requirement for human health, economic stability, and intergenerational justice. The burden of environmental degradation disproportionately impacts the poor and marginalized, reinforcing the urgent call for inclusive and enforceable action across local, national, and global scales. Healthcare systems can utilize healthcare environment data to proactively track and study the causal links and effects of adverse health impacts from pollution, and the data can be useful for improving public policies

## References


Abideen, Z., Ansari, R., Hasnain, M., Flowers, T. J., Koyro, H. W., El-Keblawy, A., & Khan, M. A. (2023). Potential use of saline resources for biofuel production using halophytes and marine algae: Prospects and pitfalls. *Frontiers in Plant Science, 14*, 1026063. https://doi.org/10.3389/fpls.2023.1026063

Adams, E. A., Stoler, J., & Adams, Y. (2020). Water insecurity and urban poverty in the Global South: Implications for health and human biology. *American Journal of Human Biology, 32*(1), e23368. https://doi.org/10.1002/ajhb.23368

Adigun, O. J., & Odeleye, D. A. (2025). The devastating consequences of environmentapollution on human health. *British Journal of Multidisciplinary and Advanced Studies, 6*(1), 37–46.

Afriyie, D., Wang, Z., Hu, S., Ampofo, G. K. M., & Asante, D. A. (2023). Exploring the dynamic nexus between urbanization and industrialization with carbon emissions in Sub-Saharan Africa: Evidence from panel PMG-ARDL estimation. *Environmental Science and Pollution Research, 30*(3), 6373–6389. https://doi.org/10.1007/s11356-022-24923-1

Ajibade, F. O., Adelodun, B., Lasisi, K. H., Fadare, O. O., Ajibade, T. F., Nwogwu, N. A., ... & Wang, A. (2021). Environmental pollution and their socioeconomic impacts. In *Microbe-mediated remediation of environmental contaminants* (pp. 321–354). Woodhead Publishing. https://doi.org/10.1016/B978-0-12-821199-1.00017-1

Amarachi, N., Emeka, O., Christopher, A., Lovell, A., & Conrad, E. (2016). Emissions of gasoline combustion by-products in automotive exhausts. *International Journal of Scientific Research Publications, 6*(4), 464–2250.

Bain, P. G., Milfont, T. L., Kashima, Y., Bilewicz, M., Doron, G., Garðarsdóttir, R. B., & Saviolidis, N. M. (2016). Co-benefits of addressing climate change can motivate action around the world. *Nature Climate Change, 6*(2), 154–157. https://doi.org/10.1038/nclimate2814

Balabadra, D. (2022). *Mitigating air pollution caused by vehicle traffic* (Doctoral dissertation). School of Planning and Architecture, Bhopal.

Balali-Mood, M., Naseri, K., Tahergorabi, Z., Khazdair, M. R., & Sadeghi, M. (2021). Toxic mechanisms of five heavy metals: Mercury, lead, chromium, cadmium, and arsenic. *Frontiers in Pharmacology, 12*, 643972. https://doi.org/10.3389/fphar.2021.643972

Bartram, J., Baum, R., Coclanis, P. A., Gute, D. M., Kay, D., McFadyen, S., & Rouse, M. J. (Eds.). (2015). *Routledge handbook of water and health* (pp. 1–732). Routledge.

Baweja, P., Kumar, S., & Kumar, G. (2020). Fertilizers and pesticides: Their impact on soil health and environment. In *Soil health* (pp. 265–285). Springer. https://doi.org/10.1007/978-981-13-5904-0_12

Bhatia, A., Singh, S., & Kumar, A. (2015). Heavy metal contamination of soil, irrigation water and vegetables in peri-urban agricultural areas and markets of Delhi. *Water Environment Research, 87*(11), 2027–2034. https://doi.org/10.2175/106143015X14362865226852

Bhattacharjee, S., Singh, Y., & Singh, A. (2024). Pollution and youth health. In *Lifestyle diseases in adolescents: Addressing physical, emotional, and behavioral issues* (pp. 179–197). Bentham Science Publishers. https://doi.org/10.2174/9789815196046124010011

Brack, W., Ait-Aissa, S., Backhaus, T., Birk, S., Barceló, D., Burgess, R., & Altenburger, R. (2019). Strengthen the European collaborative environmental research to meet European policy goals for achieving a sustainable, non-toxic environment. *Environmental Sciences Europe, 31*(1), 1–9. https://doi.org/10.1186/s12302-019-0211-5

Brown, E., Cloke, J., Gent, D., Johnson, P. H., & Hill, C. (2014). Green growth or ecological commodification: Debating the green economy in the Global South. *Geografiska Annaler: Series B, Human Geography, 96*(3), 245–259. https://doi.org/10.1111/geob.12043

Canipari, R., De Santis, L., & Cecconi, S. (2020). Female fertility and environmental pollution. *International Journal of Environmental Research and Public Health, 17*(23), 8802. https://doi.org/10.3390/ijerph17238802

Cohen, A. J., Ross Anderson, H., Ostro, B., Pandey, K. D., Krzyzanowski, M., Künzli, N., & Smith, K. R. (2005). The global burden of disease due to outdoor air pollution. *Journal of Toxicology and Environmental Health, Part A, 68*(13–14), 1301–1307. https://doi.org/10.1080/15287390590936166

Corvalan, C., Hales, S., & McMichael, A. J. (2005). *Ecosystems and human well-being: Health synthesis*. World Health Organization. https://www.who.int/publications/i/item/9241563095

Dave, S., Sainy, M., Sharma, D., & Singh, A. (Eds.). (2023). *Climate change management and social innovations for sustainable global organization*. IGI Global. https://doi.org/10.4018/978-1-6684-6313-7

Doğru, S., Argun, Y. A., Bingül, Z., & Altıkat, A. (2016). Negative impacts of air pollution on historic-cultural structures. In *UEMK 2016 Conference Proceedings* (pp. 126–131).

Dong, J., Li, D., Wang, W., Gong, Y., Wang, Y., Yang, J., & Jin, Y. (2023). Air pollution exposure during pregnancy and adverse birth outcomes in China: A population-based prospective cohort study. *The Lancet Regional Health – Western Pacific, 35*, 100808.https://doi.org/10.1016/j.lanwpc.2023.100808

Ezeh, P. C., Akinyemi, B. E., & Mohammed, S. A. (2021). Air pollution and global burden of diseases: A review. *International Journal of Public Health and Safety, 6*(3), 2167–7253. https://doi.org/10.35248/2736-6189.21.6.232

Fan, Y. V., Lee, C. T., Lim, J. S., Chang, C. T., & Klemeš, J. J. (2020). Evaluation of effective pollution control and circular economy waste treatment strategies to achieve UN-SDGs. *Cleaner Environmental Systems, 1*, 100001. https://doi.org/10.1016/j.cesys.2020.100001

Farooq, S., Ahmad, S. R., & Sheraz, M. (2019). Solid waste management in Pakistan: A qualitative investigation of public awareness and

environmental pollution. *Environmental Science and Pollution Research, 26*, 23719–23730. https://doi.org/10.1007/s11356-019-05614-3

Fatima, T., & Haider, M. (2023). Addressing the plastic pollution crisis: A holistic policy framework for Pakistan. *Sustainable Environment Research, 33*(1), 1–13. https://doi.org/10.1186/s42834-023-00172-z

Fiore, A. M., Naik, V., & Leibensperger, E. M. (2015). Air quality and climate connections. *Journal of the Air & Waste Management Association, 65*(6), 645–685. https://doi.org/10.1080/10962247.2015.1040526

Frieden, T. R. (2010). A framework for public health action: The health impact pyramid. *American Journal of Public Health, 100*(4), 590–595. https://doi.org/10.2105/AJPH.2009.185652

Friel, S., Hattersley, L., Ford, L., & O'Rourke, K. (2015). *Evidence review: Addressing the social determinants of inequities in healthy eating*. National Centre for Epidemiology and Population Health, Australian National University. https://apo.org.au/node/54175

Fuller, R., Landrigan, P. J., Balakrishnan, K., Bathan, G., Bose-O'Reilly, S., Brauer, M., & Yan, C. (2022). Pollution and health: A progress update. *The Lancet Planetary Health, 6*(6), e535–e547. https://doi.org/10.1016/S2542-5196(22)00090-0

Gaurav, K., & Singh, A. K. (2022). Air pollution and mental health: A review of epidemiological evidence. *Environmental Advances, 8*, 100206. https://doi.org/10.1016/j.envadv.2022.100206

Ghosh, S. K. (2018). *Waste management and resource efficiency: Proceedings of 6th IconSWM 2016*. Springer. https://doi.org/10.1007/978-981-10-7290-1

Girdhar, A., Agarwal, S., & Sushma, S. (2020). Environmental degradation and public health: A review. *Journal of Environmental Biology, 41*(5), 1055–1061. https://doi.org/10.22438/jeb/41/5/MRN-1181

Gómez-Baggethun, E., & Naredo, J. M. (2015). In search of lost time: The rise and fall of limits to growth in international sustainability policy. *Sustainability Science, 10*(3), 385–395. https://doi.org/10.1007/s11625-015-0308-6

Gunningham, N., Kagan, R. A., & Thornton, D. (2004). Social license and environmental protection: Why businesses go beyond compliance. *Law & Social Inquiry, 29*(2), 307–341. https://doi.org/10.1111/j.1747-4469.2004.tb00338.x

Haarløv, R. T. (2024). *Making sense of air pollution modelling: Framed uncertainty* [Doctoral dissertation, University of Copenhagen].

Haines, A., Smith, K. R., Anderson, D., Epstein, P. R., McMichael, A. J., Roberts, I., ... & Woods, J. (2007). Policies for accelerating access to clean energy, improving health, advancing development, and mitigating climate change. *The Lancet, 370*(9594), 1264–1281. https://doi.org/10.1016/S0140-6736(07)61257-4

Hassan Bhat, T., Jiawen, G., & Farzaneh, H. (2021). Air pollution health risk assessment (AP-HRA), principles and applications. *International Journal of Environmental Research and Public Health, 18*(4), 1935. https://doi.org/10.3390/ijerph18041935

Hemmat, W., Hesam, A. M., & Atifnigar, H. (2023). Exploring noise pollution, causes, effects, and mitigation strategies: A review paper. *European Journal of Theoretical and Applied Sciences, 1*(5), 995–1005.

Heynen, N., Kaika, M., & Swyngedouw, E. (2006). Urban political ecology: Politicizing the production of urban natures. In *In the nature of cities* (pp. 16–35). Routledge.

Hospido, L., Sanz, C., & Villanueva, E. (2023). Air pollution: A review of its economic effects and policies to mitigate them. *Banco de España Occasional Paper, 2301*. https://www.bde.es/f/webbde/SES/Secciones/Publicaciones/PublicacionesSeriadas/Ocasional/23/Fich/oc2301e.pdf

Hunt, A., Ferguson, J., Hurley, F., & Searl, A. (2016). *Social costs of morbidity impacts of air pollution*. Organisation for Economic Co-operation and Development (OECD). https://www.oecd.org/environment/social-costs-of-air-pollution.htm

Izah, S. C., Onwudiegwu, C. A., Sylva, L., & Etim, N. G. (2024). Health and environmental justice strategies for mitigating air pollution. In *Sustainable Strategies for Air Pollution Mitigation: Development, Economics, and Technologies* (pp. 311–342). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-54637-9_13

Jessel, S., Sawyer, S., & Hernández, D. (2019). Energy, poverty, and health in climate change: A comprehensive review of an emerging literature. *Frontiers in Public Health, 7*, 357. https://doi.org/10.3389/fpubh.2019.00357

Jiang, X. Q., Mei, X. D., & Feng, D. (2016). Air pollution and chronic airway diseases: What should people know and do? *Journal of Thoracic Disease, 8*(1), E31–E40. https://doi.org/10.3978/j.issn.2072-1439.2015.11.50

Johnson, A. C., Ball, H., Cross, R., Horton, A. A., Jürgens, M. D., Read, D. S., & Svendsen, C. (2020). Identification and quantification of microplastics in potable water and their sources within water treatment works in England and Wales. *Environmental Science & Technology, 54*(19), 12326–12334. https://doi.org/10.1021/acs.est.0c03296

Johnson, G. S., Washington, S. C., King, D. W., & Gomez, J. M. (2014). Air quality and health issues along Houston's Ship Channel: An exploratory environmental justice analysis of a vulnerable community (Pleasantville). *Race, Gender & Class, 21*(3/4), 273–303.

Kapoor, N. R., Kumar, A., Kumar, A., Arora, H. C., & Kumar, A. (2024). A review of economic burden and negative health impacts due to air pollution. In *Diseases and Health Consequences of Air Pollution* (pp. 257–273). Elsevier. https://doi.org/10.1016/B978-0-323-85601-1.00013-3

Kek, C. S. (2020). *The hidden costs of rapid economic growth* (Doctoral dissertation, Massachusetts Institute of Technology). https://dspace.mit.edu/handle/1721.1/127054

Kelly, F. J., & Fussell, J. C. (2015). Air pollution and public health: Emerging hazards and improved understanding of risk. *Environmental Geochemistry and Health, 37*, 631–649. https://doi.org/10.1007/s10653-015-9720-1

Keohane, N. O., Revesz, R. L., & Stavins, R. N. (2019). The choice of regulatory instruments in environmental policy. *Environmental Law, 491–545*.

Kristanti, R. A., Hadibarata, T., Syafrudin, M., Yılmaz, M., & Abdullah, S. (2022). Microbiological contaminants in drinking water: Current status and challenges. *Water, Air, & Soil Pollution, 233*(8), 299. https://doi.org/10.1007/s11270-022-05671-1

Kumar, G. M., Chaturvedi, P., Rao, A. K., Vyas, M., Sethi, V. A., Swathi, B., & Jabbar, K. A. (2023). Flowing futures: Innovations in WASH for

sustainable water, sanitation, and hygiene. In *E3S Web of Conferences, 453*, 01040. EDP Sciences. https://doi.org/10.1051/e3sconf/202345301040

Kumar, R., Verma, A., Shome, A., Sinha, R., Sinha, S., Jha, P. K., & Vara Prasad, P. V. (2021). Impacts of plastic pollution on ecosystem services, sustainable development goals, and need to focus on circular economy and policy interventions. *Sustainability, 13*(17), 9963. https://doi.org/10.3390/su13179963

Landrigan, P. J., & Fuller, R. (2012). Environmental pollution: An enormous and invisible burden on health systems in low- and middle-income countries. *World Hospitals and Health Services, 50*(4), 35–37.

Landrigan, P. J., Fuller, R., Fisher, S., Suk, W. A., Sly, P., Chiles, T. C., & Bose-O'Reilly, S. (2019). Pollution and children's health. *Science of the Total Environment, 650*, 2389–2394. https://doi.org/10.1016/j.scitotenv.2018.09.375

Li, P., & Wu, J. (2019). Drinking water quality and public health. *Exposure and Health, 11*(2), 73–79. https://doi.org/10.1007/s12403-018-0282-8

Li, T., Hu, R., Chen, Z., Li, Q., Huang, S., Zhu, Z., & Zhou, L. F. (2018). Fine particulate matter (PM2.5): The culprit for chronic lung diseases in China. *Chronic Diseases and Translational Medicine, 4*(3), 176–186. https://doi.org/10.1016/j.cdtm.2018.07.003

Liu, T., & Abbatt, J. P. (2021). Oxidation of sulfur dioxide by nitrogen dioxide accelerated at the interface of deliquesced aerosol particles. *Nature Chemistry, 13*(12), 1173–1177. https://doi.org/10.1038/s41557-021-00800-3

Lu, Y., Song, S., Wang, R., Liu, Z., Meng, J., Sweetman, A. J., & Wang, T. (2015). Impacts of soil and water pollution on food safety and health risks in China. *Environment International, 77*, 5–15. https://doi.org/10.1016/j.envint.2014.12.010

Magno, F. A. (2017). Environmental movements in the Philippines. In *Asia's Environmental Movements* (pp. 143–175). Routledge. https://doi.org/10.4324/9781315253205

Manisalidis, I., Stavropoulou, E., Stavropoulos, A., & Bezirtzoglou, E. (2020). Environmental and health impacts of air pollution: A review. *Frontiers in Public Health, 8*, 14. https://doi.org/10.3389/fpubh.2020.00014

Mathiarasan, S., & Hüls, A. (2021). Impact of environmental injustice on children's health—Interaction between air pollution and socioeconomic status. *International Journal of Environmental Research and Public Health, 18*(2), 795. https://doi.org/10.3390/ijerph18020795

Meo, S. A., Salih, M. A., Alkhalifah, J. M., Alsomali, A. H., & Almushawah, A. A. (2024). Environmental pollutants particulate matter (PM2.5, PM10), carbon monoxide (CO), nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), and ozone ($O_3$) impact on lung functions. *Journal of King Saud University - Science*, 103280. https://doi.org/10.1016/j.jksus.2024.103280

Mitra, P., Sharma, S., Purohit, P., & Sharma, P. (2017). Clinical and molecular aspects of lead toxicity: An update. *Critical Reviews in Clinical Laboratory Sciences, 54*(7–8), 506–528. https://doi.org/10.1080/10408363.2017.1358120

Mohamed, A. M. O., Paleologos, E. K., & Howari, F. M. (2021). Noise pollution and its impact on human health and the environment. In *Pollution Assessment for Sustainable Practices in Applied Sciences and Engineering* (pp. 975–1026). Butterworth-Heinemann. https://doi.org/10.1016/B978-0-12-823958-0.00038-4

Munsif, R., Zubair, M., Aziz, A., & Zafar, M. N. (2021). Industrial air emission pollution: Potential sources and sustainable mitigation. In *Environmental Emissions*. IntechOpen. https://doi.org/10.5772/intechopen.100245

Naidu, M., & Nqila, K. (2013). Indigenous mothers: An ethnographic study of using the environment during pregnancy. *Studies on Ethno-Medicine, 7*(2), 127–135. https://doi.org/10.1080/09735070.2013.11886458

Naik, Y., Baker, P., Ismail, S. A., Tillmann, T., Bash, K., Quantz, D., & Bambra, C. (2019). Going upstream – An umbrella review of the macroeconomic determinants of health and health inequalities. *BMC Public Health, 19*, 1678. https://doi.org/10.1186/s12889-019-7895-2

Naiman, R. J., & Dudgeon, D. (2011). Global alteration of freshwaters: Influences on human and environmental well-being. *Ecological Research, 26*, 865–873. https://doi.org/10.1007/s11284-010-0693-3

Nwe, N. S. Y. (2019). *Public perception on the effects of environmental noise pollution on people's health (A case study in Kamayut Township, Yangon)* [Doctoral dissertation, MERAL Portal]. https://meral.edu.mm/record/4931

Otero, I., Nieuwenhuijsen, M. J., & Rojas-Rueda, D. (2018). Health impacts of bike sharing systems in Europe. *Environment International, 115*, 387–394. https://doi.org/10.1016/j.envint.2018.04.006

Padulosi, S., Thompson, J., & Rudebjer, P. G. (2013). *Fighting poverty, hunger and malnutrition with neglected and underutilized species: Needs, challenges and the way forward*. Bioversity International.

Paerl, H. W., Fulton, R. S., Moisander, P. H., & Dyble, J. (2001). Harmful freshwater algal blooms, with an emphasis on cyanobacteria. *The Scientific World Journal, 1*, 76–113. https://doi.org/10.1100/tsw.2001.16

Patowary, R., Devi, A., & Mukherjee, A. K. (2023). Advanced bioremediation by an amalgamation of nanotechnology and modern artificial intelligence for efficient restoration of crude petroleum oil-contaminated sites: A prospective study. *Environmental Science and Pollution Research, 30*(30), 74459–74484. https://doi.org/10.1007/s11356-023-28227-5

Plontke, S., & Zenner, H. P. (2004). Current aspects of hearing loss from occupational and leisure noise. *GMS Current Topics in Otorhinolaryngology, Head and Neck Surgery, 3*, Doc06. https://doi.org/10.3205/cto000019

Pourvakhshoori, N., Khankeh, H. R., Stueck, M., & Farrokhi, M. (2020). The association between air pollution and cancers: Controversial evidence of a systematic review. *Environmental Science and Pollution Research, 27*, 38491–38500. https://doi.org/10.1007/s11356-020-09812-1

Quaye, D. N. D. (2018). *A comparative study of urban poverty among migrants and indigenes in the communities of Chorkor and Old Fadama, Accra* [Doctoral dissertation, University of Ghana]. http://ugspace.ug.edu.gh/handle/123456789/29937

Rakhimov, A. (2014). *Normal breathing: The key to vital health*. Createspace Independent Publishing Platform.

Rees, W. E., & Westra, L. (2012). When consumption does violence: Can there be sustainability and environmental justice in a resource-limited world? In *Just Sustainabilities* (pp. 99–124). Routledge.

Ritz, B., & Wilhelm, M. (2008). Ambient air pollution and adverse birth outcomes: Methodologic issues in an emerging field. *Basic & Clinical Pharmacology & Toxicology, 102*(2), 182–190. https://doi.org/10.1111/j.1742-7843.2007.00161.x

Salomons, E. M., & Pont, M. B. (2012). Urban traffic noise and the relation to urban density, form, and traffic elasticity. *Landscape and Urban Planning, 108*(1), 2–16. https://doi.org/10.1016/j.landurbplan.2012.07.009

Schwartz, F. W., Lee, S., & Darrah, T. H. (2021). A review of health issues related to child labor and violence within artisanal and small-scale mining. *GeoHealth, 5*(9), e2021GH000474. https://doi.org/10.1029/2021GH000474

Seguel, J. M., Merrill, R., Seguel, D., & Campagna, A. C. (2017). Indoor air quality. *American Journal of Lifestyle Medicine, 11*(4), 284–295. https://doi.org/10.1177/1559827616653343

Sharma, A., & Kumar, S. (2019). Arsenic exposure with reference to neurological impairment: An overview. *Reviews on Environmental Health, 34*(4), 403–414. https://doi.org/10.1515/reveh-2019-0007

Sharma, N., & Singhvi, R. (2017). Effects of chemical fertilizers and pesticides on human health and environment: A review. *International Journal of Agriculture, Environment and Biotechnology, 10*(6), 675–680. https://doi.org/10.5958/2230-732X.2017.00083.3

Sharma, S. B., Jain, S., Khirwadkar, P., & Kulkarni, S. (2013). The effects of air pollution on the environment and human health. *Indian Journal of Research in Pharmacy and Biotechnology, 1*(3), 391–396.

Sibley, M., Peach, K., León-Corwin, M., Selvakumar, P. P., Diodosio, K., Fox, A., & Olofsson, K. (2024). Exploring risk-scapes in Oklahoma: Institutional trust, environmental justice, climate change, and infrastructure. *Safer Communities, 23*(2), 152–170. https://doi.org/10.1108/SC-11-2023-0069

Steffan, J. J., Brevik, E. C., Burgess, L. C., & Cerdà, A. (2018). The effect of soil on human health: An overview. *European Journal of Soil Science, 69*(1), 159–171. https://doi.org/10.1111/ejss.12451

Tiwari, A. K., & Pal, D. B. (2022). Nutrients contamination and eutrophication in the river ecosystem. In *Ecological Significance of River Ecosystems* (pp. 203–216). Elsevier. https://doi.org/10.1016/B978-0-12-822414-2.00014-5

Tulchinsky, T. H., & Varavikova, E. A. (2014). Environmental and occupational health. In *The New Public Health* (3rd ed., pp. 471–526). Academic Press. https://doi.org/10.1016/B978-0-12-415766-8.00011-4

Vig, N. J., & Kraft, M. E. (Eds.). (2012). *Environmental policy: New directions for the twenty-first century* (8th ed.). Sage Publications.

Villanueva, C. M., Kogevinas, M., Cordier, S., Templeton, M. R., Vermeulen, R., Nuckols, J. R., & Levallois, P. (2014). Assessing exposure and health consequences of chemicals in drinking water: Current state of knowledge and research needs. *Environmental Health Perspectives, 122*(3), 213–221. https://doi.org/10.1289/ehp.1206229

Zhao, P., Sanganyado, E., Wang, T., Sun, Z., Jiang, Z., Zeng, M., & Liu, W. (2022). Accumulation of nutrients and potentially toxic elements in plants and fishes in restored mangrove ecosystems in South China. *Science of the Total Environment, 838*, 155964. https://doi.org/10.1016/j.scitotenv.2022.155964

Zinsstag, J., Kaiser-Grolimund, A., Heitz-Tokpa, K., Sreedharan, R., Lubroth, J., Caya, F., & De la Rocque, S. (2023). Advancing One human–animal–environment Health for global health security: What does the evidence say? *The Lancet, 401*(10376), 591–604. https://doi.org/10.1016/S0140-6736(22)02434-9