

Air Pollution and Human Security in Pakistan: Assessing a Multidimensional Environmental Threat

Dr. Bilal Aslam¹, Warisha Shahadat², Zaryab Ahmad Hassan Chattha³

¹Assistant Professor, School of Integrated Social Sciences, The University of Lahore, Pakistan.

²Graduate, School of Integrated Social Sciences, The University of Lahore, Pakistan.

³Researcher & Legal Practitioner at Punjab Bar Council, Lahore, Pakistan.

Corresponding Author: ¹ bilal.aslam@siss.uol.edu.pk ORCID: [0000-0002-2733-9704](https://orcid.org/0000-0002-2733-9704)

Received: 04-08-2025

Revised: 24-09-2026

Accepted: 18-10-2026

Published: 19-10-2026

Suggested Citation: Dr. Bilal Aslam, Warisha Shahadat, Zaryab Ahmad Hassan Chattha “Air Pollution and Human Security in Pakistan: Assessing a Multidimensional Environmental Threat.” Lahore Institute for Research and Analysis Journal 4 (2026): 30–40.

Abstract - Air pollution and smog have become a major challenge to human security in Pakistan, not only in terms of environmental degradation but also in terms of public health, livelihoods, economic productivity and the daily life of vulnerable people. This study examines how air pollution and smog affect human security and why existing policy and institutional responses have not been adequate. The study is based on qualitative research supplemented by descriptive secondary air-quality evidence. The human security perspectives of peer-reviewed literature, institutional publications and news reports were analyzed across seven human security dimensions: Economic, Health, Food, Environmental, Political, Personal, and Community Security. The majority of the evidence available relates to the state of Punjab, particularly Lahore, Multan and Faisalabad, and results are generalized across Pakistan. The results indicate that evidence is most robust for food security, health security, and descriptive measure of exposure, and is less robust for psychological effects. The primary governance and implementation challenges are weak enforcement of environmental laws, a lack of monitoring outside of the major cities, weak coordination between institutions, and a reactive approach to seasonal smog in response. According to the study, public health or environmental problems need not be taken care of only as environmental or public health problems; air pollution and smog should be treated as a multiple dimensioned human security problem. It calls for more robust implementation, more broad surveillance, more interagency collaboration, more specific protection of vulnerable communities and more proactive planning ahead of season, and prioritizes empirical research into facilities in the future.

Keywords – Air Pollution, Smog, Human Security, Environmental Degradation, Public Health



This is an open access article under the license ([Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License](https://creativecommons.org/licenses/by-nc-nd/4.0/).)

1. Introduction

Air pollution is primarily the result of human activities and not of natural weather patterns such as rain or wind. The main sources are vehicular emissions, industrial smoke, the burning of crop residues after harvest, the use of low-quality fuel, brick kilns and open waste burning. Smog occurs when contaminated air combines with moisture or fog, particularly in the winter season. It forms a dense layer of haze over cities, which reduces visibility, makes breathing difficult and

makes the air unsafe. Cities in Pakistan are frequently among the most polluted in the world. In 2023, Pakistan was one of the three most polluted countries, with average PM_{2.5} concentrations about fifteen times the level recommended by the World Health Organization.

The traditional concept of national security is state-centric, but human security is now considered an essential element in the national security calculation. Environmental degradation and air pollution are therefore increasingly regarded as threats to security. Smog has become a recurring public-health crisis in Pakistan, especially in Punjab, where cities such as Lahore and Multan are covered by smog of hazardous levels in winter. A large number of people fall ill because of poor air quality, and authorities have responded with school closures, restrictions on vehicle movement and warnings to stay indoors.

This paper treats air pollution and smog as a human security problem and not only as an environmental or technical one. Human security serves as its analytical system, and the evidence is examined under six dimensions: health, economic, and livelihood food, social, and psychological, environmental, and environmental justice, and governance and institutional security. Pakistan is the national context of the study, but most of the available evidence concerns Punjab, Mostly Lahore, Multan, and Faisalabad, and the claims made in the paper are qualified so. The paper first reviews the literature and sets out the research gap, research questions, analytical setup and approach. It then presents the findings, interprets them in the discussion, and ends with the limitations, recommendations, and conclusion.

2. Literature Review

The literature is presented as themes, based on the human security pillars used in this study. For each theme, the review presents the current evidence, and the gaps in evidence.

2.1 Sources, Seasonality, and Exposure

Where does smog Come from? When smog forms, it releases pollutants into the air in quantities that could be harmful to human health, wildlife, and the environment. The main pollutants are particulates (PM_{2.5} and PM₁₀), nitrogen oxides (NO_x), sulphur dioxide (SO₂), ozone (O₃), carbon monoxide (CO), and volatile organic compounds (VOCs). Fine particulates (PM_{2.5}) are mainly problematic because they penetrate the lungs and can enter the bloodstream, causing short-term and long-term health effects. In developing countries like Pakistan, rapid urbanization, population growth and industrialization have contributed greatly to air pollution. Smog is a particular and easily identifiable form of air pollution, which occurs when pollutants combine and interact in the air under certain weather conditions. In Pakistan, particularly in Punjab, it is usually found in the winter months, when cold air, low wind speed and temperature inversion trap pollutants near the ground. In winter smog, fog mixes with vehicular, industrial and kiln emissions and with smoke from crop burning. The thick haze lowers visibility, interferes with daily activities and is especially dangerous for children, the elderly and those with an underlying respiratory or cardiovascular condition. The number of smog cases has grown in recent years, which indicates that the problem is becoming more serious.

Several sources contribute to air pollution and smog in Pakistan. Iram et al. identify industrial activity, vehicular emissions, burning, brick kilns and urbanization as the main drivers in the country's urban areas. One of the most significant is vehicle emissions as the use of polluted fuel, low-quality fuel, and aged engines and inadequate emission standards have made transport a significant contributor to urban air pollution. CO, NO_x, hydrocarbons and particulate matter are emitted in large amounts by cars, buses, trucks and motorbikes, and research in major cities suggests that a substantial proportion of ambient pollution is linked to road transport, particularly

during the rush hour. This further reduces fuel usage and emissions due to congestion and poor public transport provision. Poor air quality is another issue caused by industry. Industrial sector comprises of textile factories, cement factories, steel factories, power plants, chemical plants, etc., and majority of them have outdated technology and lack of pollution control system. Sulfur dioxide, nitrogen oxides and particulate matter have been reported to be emitted at high levels in industrial areas of the cities of Lahore and Faisalabad. Emissions are increased by the fossil fuel power generation process, mostly using coal and furnace oil. Many industries operate with inadequate regulatory oversight and non-compliance with the environmental regulations, which means that they are not properly managing their emissions.

Another important source, but one that is not always considered, is brick kilns. Numerous kilns are in operation in the country and many use fuels that are highly polluting like coal, wood and even rubber tires. The conventional kilns are inefficient and produce black carbon, SO₂ and fine particles. Concentrations of PM_{2.5} near brick kilns have been reported as well as exceeding the guideline values of the WHO. The adoption of cleaner kiln technology has been slow due to cost, and a lack of control and resistance from the kiln owners.

Seasonal smog is also associated with agriculture, particularly burning of crop residues. During the harvest period of rice and wheat, farmers would like to burn the straw and plant residue in order to clear the field rapidly and cheaply. It is a practice with high emissions of particulate matter, smoke and greenhouse gases. The pollution level during the winters is exacerbated in South Asia by smoke from burning agricultural waste before the wheat sowing, and the Punjab government blamed some of the pollution in Lahore on smoke from burning waste in neighboring India. These pollutants can stay in the atmosphere longer during periods of low wind during the winter. Household fuel use is another source in low-income urban areas and rural areas. Many households cook and heat with solid fuels, like wood, dung and coal, creating indoor air pollution and increasing ambient pollution, especially for women and children.

2.2 Human Security and Environmental Threats

Human security shifts attention from the security of the state to the protection of individuals and communities from chronic and widespread threats to their safety and dignity. The concept was set out in the Human Development Report 1994, which identified economic, food, health, environmental, personal, community and political security as its main components.

Environmental degradation has since been treated as a threat within this framework, including in the case of Pakistan. In this context, clean, and healthy air looks like a prerequisite for a safe and dignified life.

2.3 Health Security

The health effects of air pollution and smog are the most widely studied part of the literature. Seen this way, the best-established effect is the rise in respiratory disease. Air pollution is closely linked with asthma, bronchitis, chronic obstructive pulmonary disease (COPD) and impaired lung function. Children exposed to polluted air run the risk of impaired lung development. Can alter them across their entire lifetime, and cardiovascular disease is another major concern. Fine particulate matter can enter the bloodstream and trigger inflammation, raising the risk of heart disease, stroke, and heart attacks. Epidemiological research reports an association between elevated pollution levels and cardiovascular mortality. These diseases place extra strain on the healthcare system in Pakistan, where access to care remains limited for many people. Less serious but more widespread symptoms, such as eye irritation, sore throat, cough, headache, and fatigue, appear during severe smog episodes and take a toll on productivity and quality of life.

Illness caused by smog is also associated with absence from work and school.

2.4 Economic, Livelihood, and Food Security

Beyond its health effects, air pollution carries economic and social costs. Illness caused by pollution raises healthcare costs for households and for the national economy. Higher pollution levels have been linked to rose healthcare spending by both the population and the government. Absence from work through illness, low visibility and restricted movement also reduce economic output. School closures during smog episodes interrupt education, particularly for children from disadvantaged backgrounds who may lack access to alternative learning. Agriculture is central to rural livelihoods, employment and the national food system in Pakistan, and crop residue burning links the sector directly to the smog problem. The effects of air pollution on food security, however, are not documented as directly in the sources assembled for this study as its health and economic effects, and the evidence on this pathway is limited.

2.5 Social, Psychological and Environmental Justice Concerns

Social and psychological effects are less visible than health and economic effects, but they are relevant to human security. Living with poor air, frequent illness and uncertainty about long-term health effects can contribute to stress and anxiety, and restrictions on outdoor activity during smog episodes limit children's play, the mobility of older people and community life. The sources assembled for this study, however, contain little direct evidence on these effects, and the theme is therefore treated with caution.

A related theme is environmental justice. Exposure to air pollution, and the ability to avoid it, are unevenly distributed. Households with more income can afford air purifiers, good-quality masks and cleaner home environments, while poorer households are more likely to live near highways, industrial estates or brick kilns, where pollution is highest.

2.6 Governance and Institutional Security

The governance literature points to the limited environmental monitoring mechanism, particularly outside the major cities, which makes it difficult for authorities to identify the sources of pollution, enforce regulations and respond in time. Public awareness of the dangers of air pollution is also limited, which reduces pressure on policy makers to act. Pakistan is ranked with India and Bangladesh among the most polluted countries in the world, and these regional comparisons show that air pollution is not only a national problem but also a transboundary one, in which regional cooperation is needed.

2.7 Research Gap and Contribution

Established knowledge. The sources of air pollution and smog in Pakistan, their seasonal pattern and their effects on respiratory and cardiovascular health are comparatively well documented. Limitations of earlier work. In the literature reviewed, the focus has been on health outcomes, hospitalization and temporary disruption. The effects of air pollution on wider human security, such as economic stability, livelihoods, mental and social well-being and inequality, receive less attention. Studies of policy tend to describe laws and measures and say less about why they have not worked, and about the enforcement problem in particular. Most studies also concentrate on short-term events, such as the smog of a single winter, and say less about chronic exposure and its cumulative effect on health and household expenditure. This makes it difficult for policymakers to plan effective long-term strategies. The bulk of evidence relates to urban centres, such as Lahore and Multan in Punjab, and there is limited understanding of how various groups of people in Pakistan are affected by smog. There have been very few studies exploring the impact of smog in rural versus urban areas but, the sources of pollution are different, as crop

burning and emissions from kilns are more prevalent in rural, and emissions from vehicles in urban settings. Given the evidence this study has been able to access, a systematic rural-urban comparison has not been undertaken. Its contribution is to bring dispersed evidence together under an explicit multidimensional human security framework, to show which dimensions rest on stronger and weaker evidence, and to explain through a governance and implementation analysis why existing responses have been inadequate. In this way it offers a basis for more targeted empirical research and for recommendations that follow directly from the findings.

2.8 Research Questions

This study aims to answer the following research questions:

1. How do air pollution and smog affect human security in Pakistan, with particular reference to Punjab, in terms of health, economic and livelihood, food, social and psychological, environmental and environmental justice, and governance and institutional security?
2. What governance and implementation challenges explain why existing policies and institutional mechanisms have been inadequate in addressing air pollution and protecting human security?
3. What recommendations can be made to strengthen human security through improved air quality management?

3. Analytical Framework

Human security is used in this study as an explicit analytical framework and not as a general theme. Following UNDP (1994), human security is understood as the protection of people from chronic and sudden threats to their survival, livelihood and dignity. The categories identified by UNDP (1994) were adapted to the problem of air pollution and smog and regrouped into six dimensions. Personal and community security are combined into social and psychological security, political security is treated as governance and institutional security, and environmental justice is added to the environmental dimension because exposure to air pollution is unequally distributed. Each dimension is defined in Table 1 together with the indicators used to code the evidence.

Table 1. Human security dimensions, working definitions and indicators used in the analysis

Dimension	Working definition	Indicators used in the analysis
Health security	Protection from illness, disability and premature death caused by exposure to polluted air, and access to timely health care.	Respiratory and cardiovascular outcomes; acute symptoms during smog episodes; pressure on health facilities; exposure of children, older people and people with existing conditions.
Economic and livelihood security	A stable income, work and the ability to meet basic needs and plan for the future.	Healthcare costs; absence from work and lost productivity; income loss among daily-wage earners; school closures and interrupted education; effects on business activity.
Food security	Availability of, access to and affordability of food, including the livelihoods of farmers.	Effects of pollution on crops and agricultural productivity; farm incomes; food availability and prices for households.
Social and psychological security	Freedom from persistent stress and fear, and the ability to take part in social and community life.	Reported stress and anxiety; restrictions on outdoor activity and movement; isolation of children and older people; disruption of schooling and daily routines.
Environmental security and	Protection from environmental degradation, and a fair distribution of	Pollutant concentrations against WHO guideline values; seasonal pattern; exposure

environmental justice	exposure and of the capacity to avoid it.	near highways, industrial areas and kilns; differences by income, location, age, gender and occupation.
Governance and institutional security	The capacity of institutions to prevent harm, to respond to it and to be held accountable.	Monitoring coverage; enforcement of regulation; coordination among agencies; preventive or reactive character of the response; public information and awareness.

4. Method

The study adopts a qualitative documentary research design supplemented by descriptive secondary air-quality evidence. No primary data were collected and no statistical analysis, such as correlation or regression, was carried out. Air-quality figures taken from secondary sources, such as PM_{2.5} concentrations and Air Quality Index (AQI) values, are reported as presented by those sources and are used only to describe the scale and seasonality of exposure.

The evidence base consists of peer-reviewed journal articles, institutional publications and news reports. The paper used secondary sources published between 2021 and 2026, with the exception of the foundational UNDP report of 1994, and the contemporary events described in the news reports relate to 2023 and 2024. These sources were identified using search terms related to air pollution, smog, Pakistan and human security. Sources were included if they (i) addressed air pollution or smog, or the human security concept used to frame the study; (ii) related to Pakistan, or to South Asia where Pakistan was directly addressed; and (iii) were peer-reviewed publications, official or institutional publications, or news reports on contemporary events.

Sources were excluded if they dealt with air pollution elsewhere without reference to Pakistan, or if they provided no evidence relevant to at least one of the six dimensions.

Each source was read in full. Relevant passages were extracted and coded deductively against the six dimensions and the indicators in Table 1, and the coded evidence was then compared across the different types of sources. Peer-reviewed and institutional sources were treated as the basis for health, psychological, economic, chronic-exposure and environmental justice claims. News reports were used only to document contemporary events and descriptive air-quality readings. For each dimension, the strength of the evidence was described as stronger, moderate or limited, according to the number and type of sources supporting it and to whether the effect was directly documented or only inferred.

5. Results & Findings

The WHO global air quality guidelines recommend an annual mean PM_{2.5} concentration of no more than 5 µg/m³ and a 24-hour mean of no more than 15 µg/m³. Against this benchmark, IQAir data reported by Reuters put the average PM_{2.5} concentration of Pakistan in 2023 at 73.7 µg/m³, about fifteen times the recommended level, and ranked Pakistan among the three most polluted countries. During the smog episode of November 2024, IQAir rated Lahore the most polluted city in the world with an AQI of 1,165, which Reuters reported as more than 120 times the level recommended by WHO. The sources place smog in the winter months, with the 2024 episode reported in November. Reuters reports that winter pollution recurs every year in parts of South Asia as cold air traps emissions, dust and smoke from the burning of crop residues, and that the Punjab government attributed part of the 2024 pollution to smoke from neighboring India. The systematic review by Iram et al. covers studies from several cities of Pakistan, including Lahore, Faisalabad, Multan and Rawalpindi. It identifies air pollution and smog as a serious public-health problem, reports respiratory and cardiovascular outcomes among their effects, and includes studies that report rises in hospital admissions, respiratory symptoms and

cardiovascular events in smog-exposed groups. The same review covers symptoms affecting the eyes, nose and throat, and allergies. WHO provides the institutional evidence that fine particulate matter can enter the bloodstream and is associated with cardiovascular disease and respiratory disease. Children, older people and those with an underlying respiratory or cardiovascular condition are identified as the groups most at risk. The sources also report that illness caused by pollution puts additional strain on a healthcare system to which many people have limited access. During the November 2024 episode, authorities in Lahore curbed activities and, according to the sources, closed schools and restricted outdoor activity as a way of limiting exposure.

The sources report that illness caused by pollution raises healthcare costs and that higher pollution levels are linked to higher healthcare spending by both the population and the government. Iram et al. examine the health costs of smog in Pakistan within an integrated economic framework that links pollution, urbanization and governance. Absence from work through illness and reduced movement lowers productivity, and workers who depend on daily wages lose income when they cannot work.

There is limited evidence available to establish the direct linkage of the effects of air pollution on food security in Pakistan. Although, the sources demonstrate that crop residue burning is a contributor to the smog and agriculture as central to rural livelihoods, but they do not quantify the effects of pollution on crop health, farm incomes or food prices.

The assembled sources contain little direct evidence on stress, anxiety or social isolation caused by smog. What is documented concerns the restrictions placed on daily life during smog episodes, including advisories to stay indoors, curbs on activities and school closures. Claims about psychological and social effects beyond this rest largely on inference and are not supported by direct evidence in the sources assembled.

The descriptive evidence demonstrates that PM_{2.5} levels in Pakistan are well beyond the WHO guideline levels and that smog occurs in winter. About exposure distribution, the sources link greater exposure with proximity to highways, industrial areas, and brick kilns, as well as unequal capacity to afford protective measures like air purifiers and good masks. One of the studies synthesized by Iram et al. reports a higher proportion of low socioeconomic strata among smog-exposed participants. The evidence is stronger for the level of exposure and limited for its distribution across income groups, locations, genders, and occupations. Sources say that current environmental regulations are poor enforcement because of lack of institutional capacity, political support and poor inter-agency coordination. Monitoring systems are limited outside large cities making the identification of sources and timely response difficult. Industries, vehicles, and brick kilns reportedly operate without control on emissions and fines are thought too low to induce pollution reduction. Smog mitigation consists of temporary measures on the worst days of the season, like closing factories, restricting the use of vehicles and anti-smog guns, and in November 2024, a panel was established to coordinate prevention efforts.

Pakistan is ranked with India and Bangladesh among the most polluted countries, and the Punjab government attributes part of the pollution to smoke from neighboring India.

6. Discussion

The findings support the central argument of the paper that air pollution is a human security problem and not just a technical environmental problem. The human security framework explains why the same pollution episode can be a health crisis, a livelihood shock, a source of unequal exposure, an environmental stressor and a test of institutions at the same time. It also avoids treating the population as homogeneous in terms of exposure or capacity to respond.

Human security is about protecting people from chronic and widespread threats to their safety and dignity, and clean and healthy air is a condition for such a life. The health findings show how pollution can reduce lung function, raise the risk of cardiovascular disease and, over time, limit the ability of people to live healthy and productive lives. The response to the November 2024 episode shows how far the problem reaches beyond health. That authorities find it necessary to restrict schooling and economic activity in order to keep people away from polluted air indicates that environmental degradation has become a serious threat to human security. The dimensions are not distinct. Health security turns into economic security when families use a portion of their income on health care services, and also when workers, especially workers on daily wages, are unable to earn income due to health problems. Health insecurity grows and prompt medical care is less accessible to the poor when hospitals are full. Frequent school closures can impact learning, skills and future human capital, with a few days of closure potentially having implications for future economic security. In some cities, the duration of smog exposure may impact tourism and business and investor confidence, but these impacts are not directly documented here.

An additional possible pathway is food security. Pollution can decrease agricultural productivity, which may affect farmers' livelihoods and strain food markets and purchasing power of households. Environmental degradation may then lead to a continuum of insecurity from pollution to agricultural impacts and agricultural impacts to livelihood loss and livelihood loss to food insecurity. This chain is possible, but has not been substantiated by the sources collected and must be substantiated by empirical testing. It is the same for the psychological dimension. The constant exposure and the lack of certainty regarding the long-term health effects can lead to stress and anxiety, while hindrances to mobility can impact social and community life, but there is little direct evidence in the sources compiled in this paper for Pakistan. From the perspective of UNDP, smog poses a threat to freedom from want due to the costs of its impact on human health and the loss of income, and to freedom from fear due to the continued exposure to a threat that is difficult to avoid.

Air pollution also reinforces existing social inequalities. Wealthier households can afford protective measures such as air purifiers, good masks and a cleaner home environment, while poorer households are more likely to live close to major highways, industrial estates or brick kilns, and have fewer resources to reduce their exposure. Environmental risk is therefore unequally distributed, which upholds inequality and injustice. From a human security perspective, this unequal exposure is a failure to give all people equal protection against life-threatening hazards. The evidence for it is still limited, because the sources do not systematically disaggregate exposure by income, location, gender or occupation.

The second research question asked why existing policies and institutional mechanisms have been inadequate. The sources point to five main challenges and one cross-cutting dimension. The first is an enforcement gap. Environmental laws exist, but industries, vehicles and brick kilns frequently operate without proper emission controls, and the penalties for violations are not sufficient to prevent pollution. The second is a data gap. Monitoring is concentrated in the main cities and authorities will not know where to target measures and enforce regulation, while responses may be too late. The third is poor coordination. Air quality is affected by transport, industry, agriculture, energy, health, and local government, yet the pollution sources they highlight indicate poor cooperation, even though they do not provide detailed maps of which institution is responsible for what. Fourth is the pressure of politics and economics, given that

authorities could be reluctant to crack down on polluters if it affects industrial production or jobs. Fifth is the reactive attitude. Temporary factory closures, traffic restrictions and the anti-smog water cannon are deployed at the worst moments of the season. There may be a short-term solution to pollution but the root causes - fuel transport agriculture and industrial technology are not addressed. Many experimental solutions such as artificial rain have also raised alarm at their possible impact on the environment. The common link is transboundary the Punjab government says some of the pollution comes from India, which neighbors all of Pakistan's major cities; in fact, the country is ranked with India and Bangladesh among the most polluted. This illustrates why seasonal emergency actions cannot become permanent protection and makes a compelling case for permanent, multidimensional policy solutions to replace reactive, ad hoc policy measures.

The results indicated that the development of smog in Pakistan is very seasonal. The concentration of pollutants is greater during the winter when the air is cooler and the wind velocity is lower, which reduces the dispersion of pollutants. Seasonal peak is increased by human activities. After harvest, the burning of crop residues causes a significant amount of smoke and particulate matter and therefore the amount of pollution exceeds the capacity of the environment to disperse the pollution in combination with the pollution from vehicles, from industry and from the kiln. The same conditions and activities repeat themselves each year, so it is no longer serendipitous occurrence, but a predictable one, and thus, more effective preventative measures can be implemented. The consequences can be summarized on the dimensions. Health security is affected because large numbers of people are exposed to unhealthy air. Economic security is affected by healthcare costs, lost productivity and interrupted education. Environmental security is weakened because pollution can harm ecosystems, agriculture and natural resources, although this is only partly documented in the sources assembled. Social and psychological security may be affected through stress, inequality and restricted freedom of movement.

The recommendations below follow directly from the findings and are grouped according to the human security problem they address (Table 3).

Table 2. Findings, recommended actions and implementation

Finding addressed	Recommended action	Implementation
Uneven monitoring and limited preventive capacity (governance; environmental)	Expand continuous monitoring beyond major cities; publish calibrated, real-time data; combine ground stations with satellite and meteorological information; issue location-specific early warnings.	Federal and provincial agencies should agree on common data, reporting and public-alert standards.
Persistent transport and industrial emissions (environmental; governance)	Strengthen vehicle inspection and maintenance; improve public transport; enforce fuel and industrial emission standards; require functioning control equipment at factories and brick kilns.	Use transparent inspections, escalating penalties and incentives for verified compliance.
Crop-residue and open-burning contribution (environmental; food; economic)	Provide farmers with practical, timely alternatives such as residue collection, composting and no-burn support; enforce restrictions on open burning where alternatives are available.	Coordinate agriculture, environment and local-government agencies before the harvest season.
Health and livelihood insecurity (health; economic)	Prepare seasonal public-health plans with risk communication, primary-care surge capacity,	Link air-quality alerts to health-service protocols instead of issuing warnings without support.

Unequal exposure and protective capacity (environmental justice; social)	mobile services, and protection for outdoor workers and vulnerable groups. Map exposure near highways, industrial zones, kilns, schools and low-income settlements; target masks, health services, school protections and cleaner household energy to high-risk communities.	Use data disaggregated by location, age, gender, income and occupation.
Crisis-oriented governance (governance)	Create an accountable interagency mechanism with measurable targets for monitoring coverage, emission reduction, enforcement and public-health protection.	Publish periodic performance reports so that progress and implementation gaps can be assessed against preventive capacity, implementation capacity and protective reach.

The study also proposes further measures that follow from the exposure and governance findings. National air quality standards should be aligned progressively with WHO guidelines. Clean transport should be encouraged through financial incentives for electric and low-emission vehicles and through investment in public transport. Factories and brick kilns should be required to install filters, scrubbers and other pollution-control devices, with incentives for those that comply consistently. Urban planning should give greater place to green areas, urban forests and green buffers, which may help to intercept pollutants, and should manage urban sprawl and overcrowding. Finally, education and awareness programs in school curricula, supported by the media, civil society and community organizations, can promote responsible behavior such as reduced vehicle use, avoidance of open burning and the use of clean energy.

7. Conclusion

This study reviewed air pollution and smog in Pakistan as a multidimensional threat to human security employing qualitative research based on the secondary data. The evidence reveals that air pollution and smog have an impact on health security, and that it also has an impact on economic and livelihood security, environmental security and environmental justice, and governance and institutional security. The existing measures to address the issue of smog and air pollution are found to be inadequate because of poor enforcement, lack of monitoring in places other than large cities, poor coordination between institutions, political and economic pressures, and a reactive and short-term approach to seasonal smog. A transboundary dimension is also added to these challenges and they cannot be solved through the national measures alone. To safeguard human security and improve air quality in Pakistan, a holistic intervention is needed that combines good governance, technology and public participation. This implies enhanced law enforcement, expanded monitoring and early warning, cleaner transport and industries, practical assistance to farmers for elimination of crop residue burning, public health preparedness and continuous education and awareness.

References

- Akbar, M Bilal, Amna Arif, and A Khalid. "A Social Marketing Perspective on Tackling SMOG – An Example From Lahore." *Social Marketing Quarterly* 31, no. 3 (2025): 317–23. <https://doi.org/10.1177/15245004251357518>.
- Akram, Hamza, Jinchao Li, and Waqas Ahmad Watto. "The Impact of Urbanization, Energy Consumption, Industrialization on Carbon Emissions in SAARC Countries: A Policy Recommendations to Achieve Sustainable Development Goals." *Environment, Development and Sustainability* 28, no. 4 (2026): 9635–66. [https://doi.org/https://doi.org/10.1007/s10668-024-05365-z](https://doi.org/10.1007/s10668-024-05365-z).

- Ali, Muhammad Imran. "Navigating Smog : Legislation Addressing Children ' s Right to Health in India and Pakistan." *Human Rights in the Global South (HRGS)* 2, no. 2 (2023): 135–57. <https://doi.org/http://doi.org/10.56784/hrgs.v2i2.74> 1.
- Aslam, Bilal, Shabnam Gul, and Muhammad Faizan. "Evaluation of Environmental Degradation as an Unprecedented Threat to Human Security in Pakistan." *Liberal Arts & Social Sciences International Journal (LASSIJ)* 5, no. 1 (2021): 197–211. <https://doi.org/https://www.ideapublishers.org/index.php/lassij>.
- Ezani, Eliani. "Impact of Fog on Human Health." In *Fog: Formation, Chemistry, Dynamics, Impact and Dissipation*, 153–66. Springer, 2025.
- Iqbal, Tehseen. "EDITORIAL Address for Correspondence :." *Pak J Physiol* 20, no. 4 (2024): 20–21.
- Iram, Shazia, Iqra Qaisar, Rabia Shabbir, Muhammad Saleem Pomee, Matthias Schmidt, and Elke Hertig. "Impact of Air Pollution and Smog on Human Health in Pakistan : A Systematic Review †." *Environments* 12, no. 46 (2025): 1–24. <https://doi.org/https://doi.org/10.3390/environments12020046>.
- Kumar, Manish, Viresh Kumar, Dolly Rani, Shruti Srivastava, Disha Arora, and Rupesh K Gautam. "Pollution Control Strategies Tailored for Factories and Manufacturing Plants." In *Integrating Nanotechnology and AI to Address Air and Noise Pollution*, 441–65. Springer, 2026.
- Maqsood, Diyab Ahmed, Shumaila Naz, Saba Liaqat, Hasam Saleem, Qaali Salad, Asia Rahman, and Khan Lodhi. "Impact of Air Pollution on Urban Respiratory Health Outcomes : A Systematic Review From Pakistan ' s Perspective." *Journal of Health, Wellness and Community Research* 4, no. 4 (2026): 1–7. <https://doi.org/https://doi.org/10.61919/e8yce795>.
- Mehboob, Riffat. "Smog Exposure and Its Consequences for Human Health in Lahore." *Pakistan Journal of Health Sciences* 6, no. 11 (2025): 1–2. <https://doi.org/10.7759/cureus.2111>.
- Yousaf, Nawaz, Rab, Arooj Ashraf, Iqra Nasim, Muhammad Atif Irshad, Qamar Uz Zaman, and Maria Latif. "Assessing the Status of Air Pollution in the Selected Cities of Pakistan." *Pollution* 9, no. 1 (2023): 381–91. <https://doi.org/http://doi.org/10.22059/POLL.2022.347922.1604>.
- Programme, Development. "DEVELOPMENT REPORT 1994." New York: New York Oxford University Press, 1994.
- Smedley, Tim. *Clearing the Air: The Beginning and the End of Air Pollution*. Bloomsbury Publishing, 2019.
- Sumair, Umama, Syed Raghav , Ali, and Abbas Rashid Butt. "Air Pollution in Urban Pakistan: Understanding, Sources, Differences and Similarities of Pollution." *Journal of Climate and Community Development* 3, no. 2 (2024): 69–82. <https://joccd.com/index.php/joccd/article/view/39/33>.
- Usman, Muhammad, Sohail Amjad, and Asif Khan. "Clearing the Air: Legal Strategies for Combating Smog and Pollution." *Journal of Strategic Policy and Global Affairs* 4, no. 01 (2023): 15–21.
- World Health Organization. "WHO Global Air Quality Guidelines: Particulate Matter (PM2.5 and PM10), Ozone, Nitrogen Dioxide, Sulfur Dioxide and Carbon Monoxide. Executive Summary." Geneva, 2021. <https://iris.who.int/home>.
- Zeeshan, Muhammad. "Spatiotemporal Analysis of Tropospheric Nitrogen Dioxide Hotspot over Lahore Division in Pakistan." *Discover Environment* 3, no. 1 (2025): 113. <https://doi.org/https://doi.org/10.1007/s44274-025-00323-6>.