(BS) IN PUBLIC HEALTH

"ASSESMENT OF PUBLIC PERCEPTION AND HEALTH IMPACT OF SMOG AMONG ADULTS IN LAHORE"

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Abstract

Smog is a major environmental and public health concern in Pakistani cities, particularly in Lahore, where seasonal air pollution has a negative impact on people's physical and emotional well-being. This cross-sectional study aimed to: (1) examine how adults perceive and understand pollution; (2) examine the health consequences of smog exposure; and (3) examine the connection between health outcomes, protective behaviors, and climate change awareness. A cross-sectional survey was completed by 369 persons (18 years of age or older) who had lived in Lahore for at least a year. To guarantee that the participants were varied in terms of age, occupation, and educational attainment, convenient sampling was employed. A systematic questionnaire that includes sociodemographic data, a Knowledge and Perception Questionnaire, a Smog and Climate Change Questionnaire, and a Health Impact Assessment Checklist was used to acquire the data. The results demonstrated that most participants had a high level of perception (77.8%) and knowledge (94.9%) on the health dangers linked to smog. Furthermore, 81.6% of interviewees acknowledged that climate change is a contributing factor to smog. According to the results of the health evaluation, respiratory symptoms were reported most frequently (mean score 2.66), while cardiovascular health problems were reported the least (mean score 1.86). The average ratings for general health complaints, skin and eye discomfort, and neurological and mental health issues varied from 2.35 to 2.40, suggesting that these were equally common. Climate change and the sense or knowledge of smog were shown to be strongly correlated, as was the use of masks or spending less time outside. However, the limited correlations between knowledge levels and health outcomes demonstrated a gap between awareness and behavioral adaptation. These findings suggest that while urban adults in Lahore understand the implications and causes of smog and the relationship to climate change, their concern may not always translate into meaningful health protection behaviors. Thus, if protective behaviors are to improve, public health interventions must utilize educational strategies that include structural supports, opportunities for real-time air quality monitoring, and considerations with framing resiliency to climate. To address the avoidable health impacts of smog in densely populated urban environments, both environmental and behavioral determinants of exposure must be targeted in the public health policy.

Keywords: *Lahore, Air Pollution, Health Belief Model, Environmental Health, Smog, Public Perception, Health Impact, Knowledge.*

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WHO:	World Health Organisation
PM2.5:	Particulate matter 2.5 micro metres
AQI:	Air quality index
COPD chronic:	Chronic obstructive pulmonary disorder
VOCs:	Volatile organic compounds
KAP:	Knowledge, attitude, and practises
HBM:	Health belief model
SDG:	Sustainable development goals
SPSS:	Statistical package for the social sciences
IRB:	Institute review board

CHAPTER 1:
INTRODUCTION

1.1 Background of the Study

Smog is a complex and hazardous form of air pollution that arises due to the combination of industrial emission, vehicular exhaustion, and specific metrological conditions. It is the major environmental and public health concern, particularly in urban areas where industrial activities in high traffic density contributes significantly to its formation (Razzaq et al., 2024). The terms mark is derived from a combination of "smoke" and "fog" highlighting its origin in air pollution caused by burning fossil fuels and other pollutants. In recent years, smog has become a critical issue in many developing countries, including Pakistan, where rapid urbanisation unchecked industrialization has led to worsening air quality, particularly in industrial cities like Lahore were rapid urbanisation and unchecked industrialization have let word Slinger quality particularly in industrial sites.

Smog is primarily classified into two types of industrial smog and photochemical smog. Industrial smog results from the burning of coal and other fossil fuels, producing a mix of sulphur dioxide (SO2) in particulate matters (PM), which can cause where respiratory and cardiovascular diseases on the other hand, photochemical smog form due to reactions of sunlight with nitrogen oxide (NOx) and volatile organic compounds (VOCs), creating ground level ozone (O3), which is harmful to human health and the environment. The metrological factors such as temperature inversion where layers of warm air trapped pollutants near the ground, preventing dispersion (Yavuz,2024) Globally, air pollution is attributed to around seven million fatalities annually, making it one of the primary causes of early mortality (World Health Organization [WHO], 2021). In Pakistan, smog is widely recognised as a serious hazard 68% of Pakistanis reported smog related health problems including coughing, flu like symptoms, breathing difficulties and I irritation in 2024 national survey (lpsos Pakistan,2024). Meanwhile in Lahore the average contribution of PM 2.5 in 2024 was recorded at over 100 $\mu g/m^3$ (20 x WHO guidelines) such that this city now ranks among the world's most populated (IQAir,2025). The health implications of smog are severe it is linked to asthma, bronchitis, cardiovascular disease is emerging evidence suggests impact on mental health and even cognitive decline (Hilger-kolb and Diehl, recent study 2025). **Smog**, a combination of smoke

and fog, is one of the many pollutants that seriously endangers people living in cities. Vehicle emissions, industrial discharges, and the burning of agricultural leftovers are its main sources. It primarily originates from the colour emission, industrial discharge, and burning of agricultural residues (Yousaf et al., 2024). Smog has become a frequent environmental and health calamity in Pakistan, especially in Lahore. With PM2.5 concentrations beyond WHO's acceptable standards of 15 $\mu g/m^3$, the city regularly ranks among the top five most polluted cities worldwide (IQAir, 2023). Temperature inversion and other meteorological factors trap pollutants close to the ground throughout the winter, increasing air pollution levels. During the winter season, metrological conditions such as temperature inversion traps pollutants near the ground, intensifying air population levels (Malik et al., 2024).

Pollution erodes quality of life and undermines economic productivity, education, and transportation. Despite the magnitude of the thread, however, there has been relatively little research into public knowledge perception and health impact regarding smog in Lahore. Beyond its effects on health, pollution lowers overall quality of life by interfering with economic output, education, and transportation. Despite the situation, little focus has been placed on how the public views it, impact on health and takes preventative measures in response to it.

1.2 Rationale and Significance of the Study

Smog is a great environmental and public health crisis and Lahore, linked to respiratory diseases, cardiovascular issues, and reduced quality of life. Despite its severe health risks, there is limited research on public knowledge and perception regarding smog as well as its direct health impact on adults. This study aimed to assess awareness, preventive behaviours, and the perceived health consequences of smoke exposure among Lahore's adult population. By identifying key demographical factors such as age, gender, education social economic status, occupation, residential proximity to high populated areas, housing conditions, pre-existing health issues, smoking status, outdoor activities duration, transportation modes, mask usage, and source of information. The findings will inform policymakers, clinicians, and environmental regulators about appropriate strategies for conducting targeted awareness programs and public-health interventions, demonstrating how these factors influence knowledge and behavioral perceptions. Additionally, it will help them comprehend the science underlying community level mitigation initiatives by creating evidence-based guidelines for air pollution mitigation policies. It aids in their comprehension of the general health effects of

smog. Promoting health will help develop a healthier and more health literate population through better awareness and preparedness and reduction risk. To contextualize public awareness and views of smog exposure as a significant factor influencing the efficacy of a health intervention, this research is essential. Although previous research in Pakistan has mostly concentrated on air quality measures (Pervaiz et al., 2024), human behavioral and perceptual domains are still not fully addressed. By recording people' views of the hazards of exposure, this study will close the knowledge-transfer gaps regarding the health effects of smog in Lahore. It will support evidence-based health education programs, promote preventative measures, and improve environmental rules' infrastructure and enforcement. Through noteworthy community engagement initiatives related to the process of pollution reduction, this also contributes to the achievement of SDGs 3 (Good Health and Well-Being) and 13 (Climate Action).

1.3 Research Problem

Elevated concentrations of particulate matter (PM2.5) in Lahore contribute to regular the occurrence of haze episodes, which are detrimental to public health. However, a glaring consequence remains that studies highlight a lack of information regarding the cognition of adults regarding smog, associated health risks, and sources of air pollution. Existing literature surrounding air pollution and health focuses primarily on environmental data or health status rather than behavioral response, cognition, or community awareness. The disconnect in the evidence of public cognition and health outcomes affects the development of effective primary prevention actions and policy. This research will contribute to the evidence base by examining public perception and health outcomes of air pollution in the form of smog in Lahore for adults.

1.4 research questioner

1. what is the level of knowledge and perception regarding smoking with health effect among adults in Lahore?

2. what are the health impacts of smoke among adults in Lahore is assessment through the Health Impact Assessment checklist?

1.5 Objectives of the Study

1. To assess the knowledge and perception of adults in Lahore regarding smog and its health effects.

2. To evaluate the health impact of smog exposure among adults in Lahore using the health impact assessment checklist.

1.6 Conceptualization and Operationalization

According to this study, smog is a concern to public health that results from human activities including burning agricultural residue, industrial discharges, and vehicle emissions mixed with atmospheric pollutants trapped by weather patterns. It is a behavioral and social health issue that affects illness patterns and quality of life in addition to being an environmental hazard.

Public perception refers to people's knowledge, awareness, attitudes, and opinions on the sources, effects, and preventability of smog. The phrase "health impact" refers to the physical symptoms and illnesses caused by smog exposure, including coughing, breathing difficulties, eye discomfort, and fatigue.

This conceptualization is based on the Health Belief Model (HBM), which explains how people's perceptions of vulnerability, severity, benefits, and challenges influence their preventative actions against health dangers like smog exposure.

Operationalization

A standardized questionnaire was employed to assess knowledge and perception of the causes, perceived severity, and understanding of the health effects of smog.

Health Impact: Evaluated using a health impact assessment checklist that records self-reported symptoms and the frequency of smog-related health issues.

Preventive Practices: Evaluated by enquiring about behaviors such as donning masks, remaining indoors, or restricting outdoor activities during periods of smog.

Variables related to demographics: Consider variables including age, gender, income, occupation, and educational attainment to investigate differences in perception and health outcomes.

This study uses the Health Belief Model to explain how adults in Lahore perceive smog as a health risk and how these perceptions influence their preventive actions. People who believe they are more vulnerable to illnesses associated with pollution and who believe that taking precautions (such wearing masks or restricting their exposure to the outdoors) is desirable are more likely to adopt protective behavior. Conversely, people who believe there are significant obstacles or little vulnerability may be less inclined to act.

The HBM and the connections between the important variables found in the study served as the foundation for the development of the conceptual framework for this investigation. Exposure to smog is thought to be the independent factor that affects health outcomes and public opinion. Health effects and preventive measures are influenced by public perception, which is gauged by knowledge, awareness, and beliefs. Age, gender, income, occupation, education, and other demographic characteristics serve as moderating variables that influence how people perceive and react.

By establishing a connection between behavioral perception, environmental exposure, and health consequences, this framework serves as the foundation for data analysis and interpretation. It makes it possible for the study to evaluate how people's cognitive comprehension of pollution translates into preventive measures and how these views correspond to the health consequences that adults in Lahore describe.

CHAPTER 2:

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction to smog and its global significance

Air pollution in the form of smog has increasingly been recognised as a critical, immediate, and chronic threat to public health and well-being worldwide. Recent synthesis and country level reports in 2024-2025 emphasis that urban smog episodes are no longer episodic nuisance but constitute sustained public health emergency many low- and middle-income settings. (Razzaq,2024; khan,2024). Smog is produced when primary pollutants particular matter, nitrogen oxide, sulphur oxide, volatile organic compounds interact with atmospheric processes, metrological conditions such as temperature inversion, low wind speed, and high relative humidity frequently convert these emissions into dense, persistent plumes that degrade air quality and visibility (Mohyuddin, 2024; Razzaq,2024).

The recent global and regional literature highlights to overlapping concerns will stop first, the burden of disease attributed to airborne particulate matters continues to mount, with recent studies documenting sharp spikes in hospital admissions, emergency room visits, an outpatient consultation correlated with high PM 2.5 episodes in 2024 (Irum,2025; Malik et al.,2024). Second, the societal and economic impact school closure workplace absentees transport distribution in health care costs have become more visible infrequently reported across urban centres in South Asia during 2024 – 2025 (UNICEF ,2024; AP,2024). This evolving evidence based sets the stage for concentrated, locally tailored research on public perception, preparedness, and the health consequences of smog precisely the focus of this thesis.

Smog has become a major environmental and public health concern on a global scale, especially in urban areas with high population density and industrialization. Nearly 99% of people on the planet breathe air that is over permissible pollution levels, according to the World Health Organization (WHO, 2021), and smog plays a major role in this global health burden. Its main constituents are nitrogen dioxide (NO_2), Sulphur dioxide (SO_2), particulate matter (PM2.5 and PM10)**,** and ground-level ozone (O_3), all of which have immediate and long-term health effects causing respiratory and cardiovascular diseases.The respiratory and cardiovascular illnesses caused by the exposure to pollutants like PM 2.5, No2, and SO2 (Kurt et al.,2016) occur often in urban areas like Beijing, Delhi, and Tehran, where adrenaline and mortality are elevated and daily life is interrupted by more frequent adverse episode events.

Major cities, like Beijing, Delhi, Tehran, and Los Angeles, typically experience these haze outbreaks due to industrial emissions, vehicular emissions, and weather patterns. These polluted aerosols penetrate deep into the respiratory tract and lead to diseases (or are precursors to disease) such as asthma, chronic obstructive pulmonary disease (COPD), cardiovascular complications, and lung cancer. In addition to the potential to cause or aggravate individual chronic conditions, smog has also been associated with adverse pregnancy outcomes, impaired lung growth in children, and increased premature mortality. From a public health perspective, air pollution also leads to increased hospital admissions, medical costs, and worsens transportation systems, education systems, and economic value added. These issues are amplified in many developing countries because the lack of monitoring systems and public awareness.

Even with a small reduction in air pollution, the annual global mean for ambient air pollution (Global Burden of Disease Study (GBD), 2020) is accountable for millions of deaths each year, making it one of the most preventable contributors to global morbidity and mortality. Adoption of clean energy regulations, vehicle emission limits, and community-level initiatives targeted at raising environmental awareness are all part of the global effort to reduce pollution. However, exposure and risk levels continue to vary by location due to differences in socioeconomic circumstances, urban planning, and policy enforcement. Developing integrated strategies that include environmental protection, public health promotion, and behavioral change requires an understanding of smog as a complex environmental and health issue.

2.2 Causes of smog in urban settings Lahore

Contemporary analysis produced in 2024 and 2025 make clear that Lahore smog is the product of multiple interacting emission sources combined with adverse meteorology. Source apportionment and chemical characterisation studies from 2024 indicate that vehicular emission, industrial stacks, brick kilns, open waste burning, and agricultural residue burning (stubble burning) are the major contributors to Lahore's PM 2.5 flow during intense haze episodes. Agricultural residue burning in Punjab during autumn and early winter in jets large quantities of fine particulate matters into the original atmosphere, subsequent transport and stagnation elevate city concentrations (FAQ,2024; Razzaq.2024).

Detailed monitoring studies conducted in Lahore during 2024 show characteristic chemical signatures of combustion derived particles (organic carbon, carbon black) together with

secondary aerosols formed from gaseous precursors (nitrogen oxide and volatile organics) which together produce photochemical smog conditions when sunlight and stable atmospheric layers are present (Mohyuddin,2024). Field based source investigation commissioned in 2024 also emphasised the role of unregulated small and medium scale industries and poorly contributed bricks kilns as persistent emission sources, particularly during low dispersion winter months (Nasar-u-Minallah,2024). Policy analysis from 2024 further attribute severity of smog to weak emission enforcement, increasing vehicle fleet without adequate emission controls, and episodic open burning practises (Razzaq,2024).

Taken together, the 2024 - 2025 literature position Lahore's smog as a multisource, multi scale problem required simultaneous interventions across transport industrial emissions, agriculture practises, and waste management sectors. The most industrialized and highly inhabited cities in Pakistan, Lahore, has frequent and severe smog outbreaks, particularly in the winter. Anthropogenic activities and unfavorable weather patterns combine to cause the phenomenon, which causes pollution to build up in the lower atmosphere. Vehicle emissions, industrial discharges, and the burning of agricultural leftovers in Punjab's neighboring districts are the main causes of pollution in Lahore (Yousaf et al., 2024). The primary sources of pollution in Lahore are vehicle emissions, industrial discharges, and the burning of agricultural waste in nearby districts of Punjab (Yousaf et al., 2024). Rapid urbanization and the exponential expansion of motor vehicles have led to an increase in the emissions of pollutants such as nitrogen oxides (NOx), Sulphur dioxide (SO_2), carbon monoxide (CO), and volatile organic compounds (VOCs). These gases react with sunlight to produce secondary pollutants including ozone and fine particulate matter (PM2.5), which are significant components of smog.

Unregulated industrial operations, particularly steel mills, brick kilns, and businesses without emission control equipment, are the main source of particulate pollution. During the post-harvest season, burning crop residue in nearby agricultural areas increases the particle load and worsens smog production. Meteorological factors including temperature inversion, low wind speed, and high humidity prevent pollutants from spreading, keeping them near the ground.

In addition, deforestation, inadequate public transport, and a dependence on fossil fuels have all contributed to Lahore's deteriorating air quality. The lack of flora in the city reduces its natural ability to absorb airborne pollutants, and heavy traffic and badly maintained automobiles emit excessive exhaust emissions. The pollution issue is made worse by seasonal changes, especially from October to February, which produce stagnant air conditions (Malik et

al., 2024). Lahore's smog problem is essentially the result of a complex interaction between human-induced emissions and climate variables, which is made worse by low policy enforcement and public misinformation. A multi-sectoral approach with stricter environmental laws, sustainable urban development, and greater community involvement is required to address these causes and reduce health hazards.

2.3 Air Quality and seasonal trends in Lahore.

In Lahore, air quality shows a distinct seasonal pattern with episodes of severe smoke, often referred to as smog, typically occurring between October and February. Stagnant winds and decreased precipitation during this season limit the ability of dispersed pollutants, leading to visibly hazy conditions and extremely high levels of particulate matter. Results from 2024, before the rain season arrived, show that concentrations regularly exceed safe limits during these months. These concentration levels reached the precipitating factor for the temporary closure of schools. Rainy weather and increased wind speeds also serve to dilute pollutants and improved air quality.

Seasonal variation emphasizes the necessity of in real-time air monitoring and establishing an early warning system for public health preparedness. It is imperative to continuously assess and report air quality with a local focus, to create a formulated action plan and raising public awareness during episodic pollution months. The air quality in the city of Lahore has significant seasonal variability and have peak smog events in the winter months. During these months smog events are characterized by a surge of particulate matter (PM2.5 and PM10) levels that often exceed 15 $\mu g/m^3$, as defined as ‘safe’ by the World Health Organization (WHO) (IQAir, 2023). These events occur when anthropogenic and meteorological factors interact to form and maintain smog conditions, which greatly reduce air quality.

During the winter, temperature inversion layers are established when cooler air can become trapped underneath a layer of warmer air thereby preventing pollutants from dispersing upward. Thus, a thick layer of smog is created as pollution generated from the vehicles on the road, the factories that consume fossil fuels and the pollutants produced from our home heating sources create a heavier concentration of air mixing at layer close to the ground. The stagnation of air is exacerbated when there are low wind speeds, high humidity, and limited amounts of rain (Majeed et al., 2023) on the other hand, higher sustained temperatures, wind, and precipitation during the summer monsoon will help dissipate air pollutants allowing for air quality to improve temporarily. These intervals of better air have been shortened, nonetheless, by ongoing

pollution sources and fast urbanization. As a result, the air quality index (AQI) in Lahore regularly changes from "unhealthy" to "hazardous," especially in the late autumn and early winter. In addition to influencing visibility and the environment, these seasonal variations in smog severity also directly impact everyday living and public health. Hospital admissions for respiratory and cardiovascular conditions tend to increase significantly during high-smog periods (Malik et al., 2024). Therefore, understanding the temporal distribution of exposure risk and directing public health preparation measures depend heavily on seasonal air quality patterns.

2.4 Global and local health impact of smog exposure

The health impact of smog exposure extensive and multifaceted will stop at the global level, millions of premature deaths are attributed to air pollution every year. Smog effect nearly every system of the human body most notably the respiratory and cardiovascular system. Individuals exposed to pollutant it often reports coughing, breathlessness, throat edition common eye burning, which can escalate into chronic conditions such as asthma and bronchitis.

In Lahore, hospitals frequently report increase patient visits during intense smog. Specially among children, the elderly, and those with pre-existing respiratory diseases. Prolonged exposure also weakens immune defences, making people more susceptible to infections. Emergency evidence suggests that air pollution not only impact physical health but also contributes to systematic inflammation and oxidation stress which may accelerate ageing and chronic diseases development. Therefore, smog represent both an immediate health hazard and a long-term public health challenge that demands preventive policy and behavioural actions.

A variety of acute and long-term health problems can result from the fine particulate matter (PM2.5) and other airborne contaminants found in smog penetrating deeply into the respiratory system. Exposure to smog has been scientifically linked to respiratory illnesses, cardiovascular diseases, and adverse mental and neurological outcomes. While long-term exposure can result in more serious illnesses such asthma, chronic bronchitis, chronic obstructive pulmonary disease (COPD), and ischemic heart disease, short-term exposure frequently causes eye irritation, coughing, throat discomfort, exhaustion, and breathing difficulties. Children, the elderly, people with pre-existing cardiovascular or respiratory disorders, and outdoor workers.

Studies conducted in Lahore have reported increased hospital admissions and outpatient visits during smog seasons, especially among patients with respiratory complications (Malik et al., 2024). Long-term exposure weakens the immune system and reduces lung function, making a person more vulnerable to viruses and other contaminants. The health burden is compounded by the continued experience of poor air quality being associated with mental stress, anxiety, and lower general quality of life in addition to physical deleterious health outcomes. Understanding the multifaceted health impact of smog is crucial to develop effective intervention measures, improving public awareness, and deliberately aligning national policies with international environmental health goals, such as Sustainable Development Goal 3 (Good Health and Well-Being).

2.5 Mental health consequences of prolonged air pollution.

In recent months, the focus has shifted towards psychological and neurological impacts of air pollution. Being in exposed to air pollutants may lead to an increase in stress, sleep disturbance, and anxiety in some cases. Some of latest impacts of air pollution include being unable to go outside and partake in recreational activities and events. Pollution can cause visibility issues, and as frequent health warnings from Counts warning signs to stay indoors, uncertainty contributes to the feeling of being caged. Community perception and awareness play an important role in how communities view surveillance of environmental health risks like air pollution. Moreover, while Lahore experiences greater frequency and severity of smog events, there is insufficient awareness among local citizens of what causes smog events, health effects, and prevention strategies to avoid air pollution. More than a few studies show a large percentage of the population thinks of smog as a seasonal or natural occurrence rather than a byproduct of human pollution (caused by vehicular emissions, industrial exhaust, and burning of crops) (Hussain et al., 2024).

Longitudinal studies from 2024-2025 suggest inhalation of fine particulate matter could alter brain function in cognitive performance through biological pathways such as hormonal changes and neuroinflammation due to environmental stresses. In Pakistan’s urban context residents experiencing repeated smog episodes often report fatigue, irritability, and decreased motivation. Call attention to a notable disparity that exists between environmental reality and public perception, which affects the adoption of preventive measures. Factors such as low literacy, misleading information, and a lack of regular health communication programs all affect low levels of awareness. Due to this, people do not always engage in behaviors to protect

themselves, such as wearing a mask or staying inside. Public attitudes and perspectives will influence the effectiveness of governmental or policy interventions regarding climate change. If communities do not recognize their personally responsibility to mitigate pollution, such as refraining from open-burning, or maintaining cars, environmental initiatives will have little or no effect. Therefore, the actions of discovering civic involvement, encouraging behavioral change or innovation, and providing long-term systems of support for air quality change will depend on citizen awareness. The value of examining public perception and awareness for the purposes of this study informs us about behavioral and cognitive changes of the participants in the context of air pollution. It assists in locating misconceptions, knowledge gaps, and driving forces behind preventive measures. Designing focused awareness campaigns, encouraging risk communication, and coordinating community behaviors with more public health and environmental sustainability objectives all depend on an understanding of these factors. Mental health impact is an overlooked but important component of smog's overall burden, warranting inclusion in future public health planning and risk communication strategies.

2.6 Social economical and demographic influence on protective behaviour

Social economic status significantly influences how individuals perceive environmental risk and adopt protective measures. Education, income, an occupation determinant both awareness level and access to resources that reduce exposure. People from higher social economical groups are generally more informed and equipped to take precautions such as wearing protective mask, using indoor air filters, and modifying outdoor routines. In contrast, low-income population, outdoor workers, informal labourers often lack these options would stop their daily livelihood depends on continuous outdoor activities, which increase exposure duration. Similarly, literacy level effect how well individual understand governmental health advisories or interpret pollution indices. People’s perceptions and reactions to the health concerns associated with smog are greatly influenced by sociodemographic and behavioral factors. The Lahore population's awareness and preventive practices are influenced by factors like **age, gender, income level, occupation, education, and occupation**. Knowing these factors makes it easier to explain why different societal groups have varied levels of **knowledge, perception, and health outcomes.**

Another set of behavioral drivers include personal health attitudes and perceived susceptibility and the perceived benefits or drawbacks of preventive actions. For example, people are more likely to modify their behavior if they believe being in smog poses an immediate health threat.

Conversely, a person is less likely to adhere to protective behaviors, if they downplay their risk or perceive barriers to adhering to preventive behaviors such as cost, discomfort, or a lack of trust in preventive behaviors. Demographic variables such as age and family composition also impact risk and protective behaviors would stop; for instance, caregivers of young children or older adults would limit exposure time or adopt preventive measures.

Recognizing these differences is important for designing suitable public health campaigns. In conclusion, dynamic nature of behavioral and sociodemographic factors plays a role on how social actors perceive smog, adopt health protective behaviors and experience health ramifications associated with further environmental health issues. Developing focused public health initiatives and policies that meet the needs of vulnerable groups and advance fair environmental health awareness throughout Lahore's varied population requires an understanding of these aspects.

2.7 Gender disparities in health risk awareness and access to resources

Gender remains a key dimension in the study of environmental health. Women and men often experience pollution differently due to biological, social, and occupational factors. Women generally express higher concerned about environmental risk and health outcomes but may face limited limitations in mobility. Decision making, or financial independence that restrict their ability to adopt protective measures.

In many low-income households, woman at expose not only to outdoors move but also to indoor pollutants from cooking fuels. Man, on the other hand often work outdoor in traffic or constructions, facing direct exposure during working hours. Gender and occupation have a significant impact on people's exposure to pollution and how they perceive the health risks associated with it. Social roles and employment trends influence how men and women in Lahore view and respond to environmental problems. In addition to determining exposure levels, these characteristics also influence access to health information and preventive behavior.

It is well known that men and women have diverse perspectives on their surroundings. Women often show more care for the health of their children and the environment than do men. However, their ability to take preventive action is sometimes limited by cultural and economic constraints. Their ability to implement preventative measures during pollution is diminished by limited mobility, reduced participation in decision making, and restricted access to

resources. episodes. Due to extended exposure to contaminated air, women who labor in the unorganized sector or conduct outdoor household tasks like street vending or laundry are at further risk for health problems. Occupational exposure is another significant element affecting the health impacts of pollution. Outdoor workers, such as rickshaw drivers, construction workers, traffic cops, and vendors, are among the most affected populations. Their prolonged exposure to vehicular and industrial pollutants increases their risk of respiratory conditions, fatigue, eye pain, and cardiovascular problems. However, albeit at much lower levels, workers in indoor or climate-controlled environments may still be indirectly impacted by their exposures.

Furthermore, access to safety equipment and occupational knowledge vary among professions. While workers in organized sectors may receive basic training or protective gear, those in informal occupations sometimes lack such precautions. This discrepancy worsens health vulnerabilities and widens the gap between awareness and action. Therefore, developing inclusive public health policy requires tackling gender and occupational disparities. Targeted initiatives like mask distribution, workplace air quality enhancements, and gender-sensitive awareness campaigns can lower these risks. Knowledge about how gender and occupation interact with exposure and perception is essential to developing equitable and successful environmental health programs in Lahore and gaining a greater knowledge of the impact of pollution on public health. current research and incorporating gender-sensitive perspectives into environmental communication and intervention design. Equal access to protective gear, such masks and clean home energy, is crucial to reducing exposure inequities both indoors and outside.

2.8 Smog Intensification and Climate Change

Climate change makes smog's declining status worse. Rising temperatures, altered wind patterns, and delayed monsoon rains have all contributed to a rise in the frequency and length of haze episodes in South Asia. In Lahore, the subject of our investigation, altered rainfall patterns and protracted dry periods have created an environment that promotes the accumulation of contaminants. One important reason that has been linked to the escalation of haze episodes in cities like Lahore is climate change. Rising global temperatures, altered rainfall patterns, and modifications in atmospheric circulation all have a direct effect on the dispersion of pollutants and the quality of the air. These changes in the climate intensify already-existing pollution issues, resulting in smog episodes that are longer and more intense.

Higher global temperatures also stimulate the formation of ground level ozone compounding the effects of particular methods the overlap between greenhouse gas emission and local air pollutants mean the act that actions take to address climate change such as reducing fossil fuel use and improving energy efficiency can also mitigate smog.Conditions that trap pollutants near the ground have been brought about in Lahore by extended dry periods, decreased winter rainfall, and an increase in temperature inversion events. Because the air cannot mix vertically due to these stationary atmospheric layers, dangerous particulate **matter (PM2.5 and PM10)** can build up in the lower atmosphere.

These climate changes increase the severity and length of smog when combined with heavy emissions from industry, cars, and agricultural burning. Furthermore, both local air quality degradation and global warming are caused by increasing greenhouse gas emissions, which are fueled by urbanization, energy consumption, and deforestation. The natural filtration of air pollutants is limited by the loss of green spaces and vegetation cover, and emission levels are further raised by rising energy needs during the winter. Consequently, Lahore experiences one of the highest air pollution indices in South Asia during winter, reflecting the combined impact of human activity and climate variability (Yousaf et al., 2024).

The interaction between pollution and climate change not only increases health risks but also complicates public health planning and policy response. As climatic trends continue to shift, it is expected that smog episodes will become more frequent, longer, and more extensive. This necessitates coordinated strategies that address climate adaptation and air pollution reduction, such as promoting the use of renewable energy sources, growing more trees, and creating sustainable transportation networks. Emissions control must be included into cities' green, sustainable transportation and renewable energy transitions to achieve both health and ecological benefits. Air quality management and climate adaptation need to be seen as connected goals. To promote lobbying for Sustainable Development Goal 13 (Climate Action), it will be helpful to understand the relationship between climate change and increased smog. To lower emissions, safeguard vulnerable populations, and guarantee improved air quality for all Lahore inhabitants, it highlights the significance of cross-sector cooperation (environment, health, and urban planning).

2.9 Research Gaps

This gap hinders the ability of policymakers and health professionals to develop targeted behavioural and educational therapies. Additionally, little is known about how sociodemographic characteristics like education, gender, income, and occupation impact protective behaviours and awareness. Another important requirement is the application of theoretical frameworks to investigate behavioural reactions to environmental health risks. Few studies in Pakistan have examined how people respond to smog exposure using psychological or health behaviour models, such as the Health Belief Model (HBM). This limits our knowledge of the mental processes that affect how each person perceives risk and takes preventative action.

To develop a comprehensive and multidimensional understanding of smog's effects, these gaps must be filled. Thus, this study attempts to close these research gaps by assessing the public's perception, awareness, and health impacts of pollution among Lahore's adult population within the framework of the Health Belief Model. To improve environmental health outcomes, the study intends to provide evidence-based insights that can direct the creation of public health initiatives, awareness campaigns, and policies. Furthermore, there are still methodological flaws in the creation of standardized instruments to evaluate public opinion and preventative actions. By using a structured approach to support perception and health impact among adults in Lahore, the current study seeks to close these gaps.

2.10 Theoretical Framework Heath Belief Model

The **Health Belief Model (HBM),** created by Rosenstock in (1974), is the foundation of the current study and is a commonly used framework for comprehending behaviour connected to health. According to the concept, people's perceptions of a given health threat's vulnerability, seriousness, advantages, and obstacles affect their actions to prevent or reduce such risks. The HBM has been successfully used to explain behavioral reactions to risks associated with the environment and disease in a variety of public health scenarios.

The HBM makes it possible for this study to investigate how perceptions affect adults' health outcomes and preventive behaviour in Lahore by combining these elements. For instance, people are more likely to adopt preventative health behaviour if they think that protective measures are effective and that they are more susceptible to illnesses linked to pollution. On

the other hand, even while they are aware of the hazards, people with low perceived sensitivity or high perceived obstacles might not take much preventive action.

Thus, the theoretical framework emphasizes that an individual's belief system, not just awareness, is what drives behaviour change, establishing a connection between public perception, behavioural reaction, and health impact. This study's incorporation of the Health Belief Model facilitates the creation of behaviorally informed treatments and helps explain differences in preventive practices among demographic groups.

All things considered, using the HBM offers a solid conceptual basis for examining how perception, behaviour, and health outcomes interact. The goals of the study are in line with larger initiatives to promote preventive behaviour, raise environmental health literacy, and lessen the burden of smog exposure on public health in Lahore.

CHAPTER 3:
MATERIALS AND METHODS

3.1 Study Design Settings and Participants

Adults living in Lahore, Pakistan, participated in this cross-sectional study to gauge their perceptions and knowledge of smog and its effects on health. The standard Health Impact Assessment Checklist was used to assess the health effects of smog exposure. Adults 18 years of age and older who had lived in Lahore permanently for at least a year, were willing to participate, and could give informed consent were the study's target participants. To guarantee that the participants were representative of the urban population, they were chosen from a variety of educational, professional, and socioeconomic backgrounds. The study excluded participants with cognitive impairments, substantial communication barriers, temporary residency, or those incapables or unwilling to give informed consent.

3.2 Sampling Technique and Sample Size Calculation

To guarantee sufficient representation from various age groups, educational levels, and occupational categories, a convenient sampling technique was used. The finite population correction formula, which is suitable when the study population is known and not very large, was used to determine the sample size. According to a recent Lahore study, during times when smog prevalence was high, about 60% of adults reported having smog-related symptoms like coughing and eye irritation (Khan & Ali, 2024). With a 95% confidence level ($Z = 1.96$), a 5% margin of error ($d = 0.05$), and this proportion ($p = 0.60$), the OpenEpi online calculator determined that 369 participants were needed for the study.

3.3 Research Instruments

Two research instruments were employed in this study. Knowledge and Perception Questionnaire. This questionnaire assessed participants' awareness, attitudes, and behaviors related to smog and its health impacts. Health Impact Assessment Checklist. This checklist identified physical and psychological symptoms associated with smog exposure. Smog and Climate Change Questionnaire. This tool evaluated participants' understanding of the link between smog, air pollution, and broader climate change phenomena. It also explored participants' perception of how climate change contributes to the worsening of air quality and public health outcomes.

3.4 Data Collection Procedure

A structured questionnaire with three primary sections was used to gather data: (a) sociodemographic data; (b) the Smog and Climate Change Questionnaire with Knowledge and Perception components; and (c) the Health Impact Assessment Checklist. Both in-person interviews and online surveys were used to administer the questionnaire to guarantee widespread participation from a variety of Lahore demographic groups. To reach participants from a variety of backgrounds, trained data collectors conducted in-person interviews in a few public spaces, medical facilities, and community centers. To reach people with digital access, an online version of the survey was disseminated concurrently through community organizations, institutional networks, and social media sites.

All participants were briefed on the study's purpose and importance prior to data collection. Before being included in the study, each participant provided written or digital informed consent. Anonymity and confidentiality were upheld during the entire study. Participants were assured that their responses would be used solely for research purposes and that they had the right to withdraw at any stage without any consequences. To guarantee accuracy and completeness, data were gathered over a predetermined period under the principal investigator's supervision.

3.5 Data Analysis

The Statistical Package for the Social Sciences (SPSS, Version 25.0) was used to enter and analyze quantitative data. Sociodemographic features and questionnaire responses were compiled using descriptive statistics, such as frequencies, percentages, means, and standard deviations. To investigate relationships between smog exposure, health effects, and protective behaviors, inferential statistical test such as chi-square tests and Pearson correlation analysis were used. Statistical significance was defined as a significance level of $p < 0.05$.

3.6 Ethical consideration

This study was conducted in accordance with ethical principles of research involving human as participants. The following ethical consideration were ensured during the research process. Ethical approval: Prior to data collection the study proposal was reviewed and approved by the concerning supervisor Dr. sidra shahid to ensure compliance to ethical standards. Information consent: All participants were informed about the purpose, objects,

and procedure of study. Participants were free to withdraw at any time. Informed consent was obtained before completing questioner. Confidentiality and anonymity: Personal information of participant was kept strictly confidential. During data collection no name, contact detail or personal information of percipient were disclosed. Ensuring participation anonymity. Voluntary participation: The participants involved were completely voluntary. They have had right to refuse any question they were uncomfortable with. Data protection: All data collected and stored securely in password protected file accessible only to researcher. Data was responsibly collected and retained after the completion of study. Respect and transparency: Purpose of research was clearly explained. No deception or misleading information was used throughout data collection or study conducting process.

CHAPTER 4:
RESULTS AND DATA ANALYSIS

4.1 Sociodemographic Characteristics of the Participants

A total of 369 adults participated in the study. Most respondents (62.6%) were aged 18–25 years, followed by 24.7% aged 26–35 years, 7.3% aged 36–45 years, and 5.4% aged above 46 years, indicating that most participants were young adults. Males made up 68.0% of the sample, while females made up 32.0%.

The ethnic makeup of Lahore's population was reflected in most respondents (78.9%) being Punjabi, followed by Pashtun (12.7%), Balochi (4.3%), and Sindhi (4.1%). 33.1% of participants made less than 50,000 PKR per month, whereas over half (66.9%) reported making more than 50,000 PKR per month.

In terms of marital status, 24.7% of participants were married, while 75.3% were single. The respondents' high level of educational attainment was demonstrated by the fact that the majority of participants (74.3%) had a science-related degree, while 19.5% studied the arts and 6.2% were illiterate. Regarding smoking history, 28.7% of participants were current or former smokers, whereas 71.3% of participants said they had never smoked.

The majority of respondents (79.7%) identified as middle class, followed by upper class (13.1%) and lower class (7.3%). The study population, which represented a varied cross-section of adults living in Lahore, was primarily young, male, Punjabi, middle-class, and well-educated.

The significant prevalence of young participants indicate that the results may significantly represent the perception of a generation that is increasingly attuned to environmental information, digital media, and health awareness indicators. Overall, this study of choice represents the social demographical characters of this sample providing essential contexts and interoperating and highlighting study findings.

Table 1: Sociodemographic Characteristics of the Study Participants (N = 369)

Variables	Category	n (%)
Age (years)	18–25	231 (62.6)
	26–35	91 (24.7)
	36–45	27 (7.3)
	>46	20 (5.4)
Gender	Male	251 (68.0)
	Female	118 (32.0)
Ethnicity	Punjabi	291 (78.9)
	Pashtun	47 (12.7)
	Sindhi	15 (4.1)
	Balochi	16 (4.3)
Monthly Income	> 50,000 PKR	247 (66.9)
	< 50,000 PKR	122 (33.1)
Marital Status	Unmarried	278 (75.3)
	Married	91 (24.7)
Type of Education	Science	274 (74.3)
	Arts	72 (19.5)
	Illiterate	23 (6.2)
Smoking History	No	263 (71.3)
	Yes	106 (28.7)
Social Class	Lower class	27 (7.3)
	Middle class	294 (79.7)
	Upper class	48 (13.0)

4.2 Levels of Knowledge about smog and its effect on health

Figure 1 illustrates the distribution of participants' knowledge levels about the health effects of smog. The majority of respondents demonstrated a good level of knowledge (94.9%), indicating that most participants were well-informed about the harmful effects of smog on human health. A smaller proportion of respondents (4.3%) had a moderate level of knowledge, while only 0.8% exhibited poor knowledge regarding smog-related health impacts.

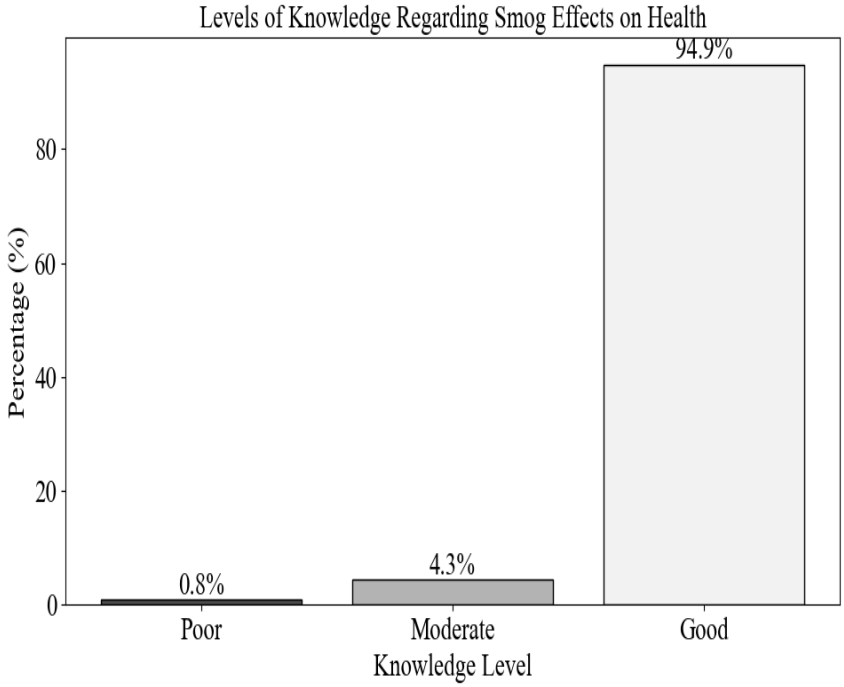

Figure 1: Levels of knowledge regarding smog effect on health

4.3 Levels of Perception about smog and its effect on health

Figure 2 presents the levels of perception among respondents about the health effects of smog. Most participants (77.8%) exhibited a high level of perception, indicating strong awareness and concern about the harmful impacts of smog exposure on human health. Around 20.9% of participants showed a moderate level of perception, while only 1.4% demonstrated a low perception level regarding smog-related health risks.

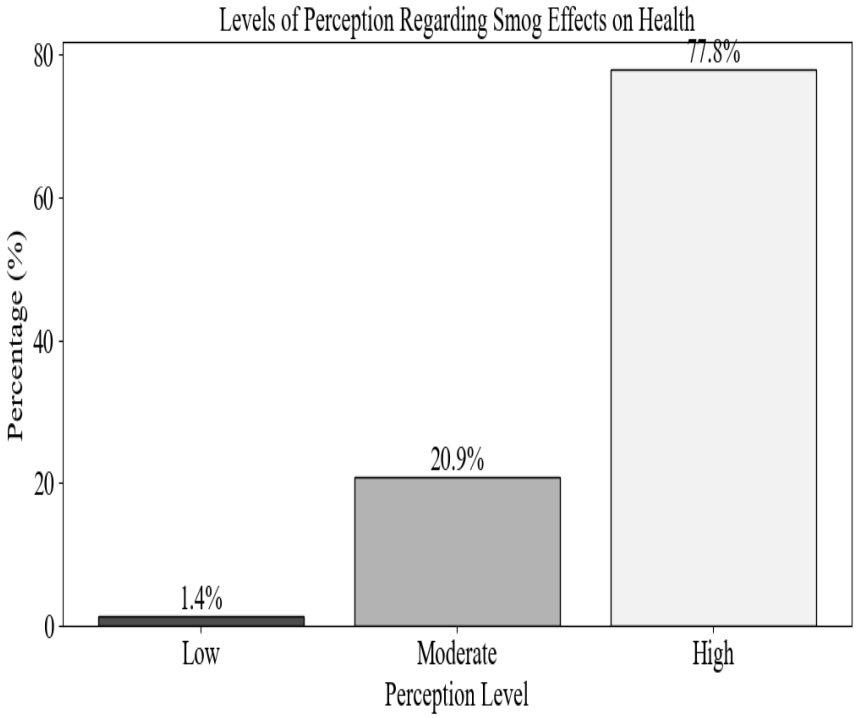

Figure 2: Levels of perception regarding smog effect on health

4.4 Health impacts of smog exposure among adults in Lahore

Figure 3 illustrates the comparison between the highest and mean scores for various smog-related health effect domains among the Lahore population. The results show that respiratory symptoms had the highest mean score (2.66), suggesting that the most frequently reported health effects linked to smog exposure were coughing, throat irritation, and breathing difficulties. Preventive measures taken (3.01), which follow, indicate that many participants

used protective measures like mask wearing, limiting outdoor activities, or using air purifiers during smog episodes.

Heart disease symptoms, on the other hand, had the lowest mean score (1.86), suggesting that participants either had fewer cardiovascular symptoms or were less conscious of the connection between smog and heart health. The mean scores for neurological and mental health issues, eye and skin irritation, and general health effects were similar (ranging from 2.35 to 2.40), indicating that smog exposure had a moderate impact on these health domains.

Table 2: Descriptive Statistics for Smog-Related Health Effect Domains among Adults in Lahore (N = 369)

Variables	Mean	Standard Deviation
Respiratory symptoms	2.66	1.89
Heart disease symptoms	1.86	1.63
Eye and skin irritation	2.40	1.52
Neurological and mental health problems	2.40	1.61
General health effect	2.35	1.55
Preventive measures taken	3.01	1.20

4.5 Perception of smog due to climate change among Lahore population

Figure 4 depicts the levels of perception regarding smog as a consequence of climate change among adults in Lahore. The findings show that most respondents (81.6%) had a high degree of perception, indicating that most participants were aware of the connection between the

production of smog and more general climate change phenomena like temperature increases, greenhouse gas emissions, and seasonal fluctuations.

Only 7.6% of respondents showed a moderate level of perception, suggesting that they were only partially aware of or unsure of this association. 10.8% of respondents, on the other hand, expressed a low perception level, indicating a lack of knowledge about the ways in which climate change influences the creation and persistence of smog.

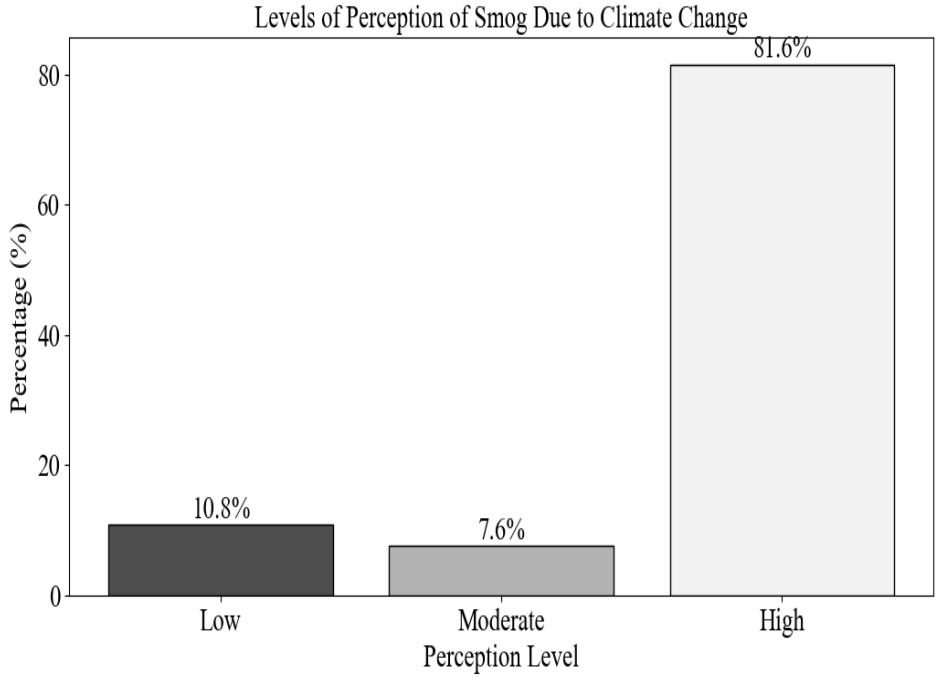

Figure 3: Perception of smog due to climate change

4.6 Correlation between exposure of smog on Lahore Population

The correlation heatmap in Figure 4 displays correlations of smog, climate change perceptions, knowledge level, and different health effect domains of the Lahore population. Relationships were categorized as either Strong (S), Moderate (M), Weak (W), and No correlation (N) based on Pearson correlation coefficients. Results demonstrated there was a strong correlation (S) between the perception of smog and climate change, suggesting people are more likely to perceive smog as an environmental threat if they understand the relationship between air pollution and climate change. Likewise, preventative behaviors exhibit a robust correlation

with climate change and smog, with those showing greater awareness engaging in the preventative behavior more extensively.

Mental health issues, general health impacts, and heart disease symptoms have moderate to strong correlations with smog exposure, suggesting individuals rating their exposure as high also showed a significant decline in general health and psychological well-being. Moderate correlations are observed between respiratory symptoms and eye and skin irritation, which is consistent with an already recognized body of medical evidence which supports correlations between air pollution, allergic reactions, and respiratory distress. The majority of health outcomes do not correlate significantly with knowledge, which suggests that knowledge might not be a reliable proxy for actual perceived or reported outcomes, on its own. Awareness does not necessarily equal behavior, which is a battle for public health interventions that influence awareness into action.

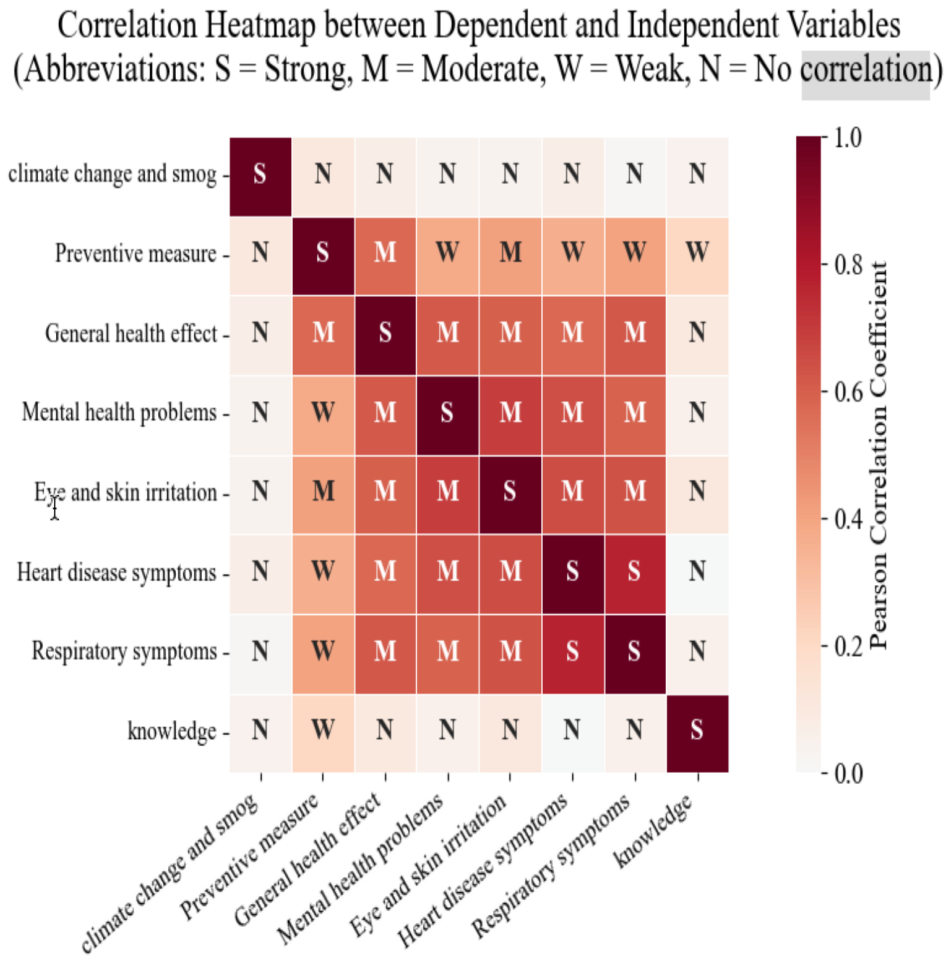

Figure 4: correlation heatmap between dependent and independent variables.

CHAPTER 5:
DISCUSSION

This current cross-sectional study of 369 adults, living in Lahore, adds valuable data on knowledge, perception, and self-reported health impacts of smog exposure. The data showed that knowledge of health effects of smog was at a high level (94.9 %), with a strong perception of health risk from smog (77.8 %). A relatively high proportion of participants (81.6 %) also understood that smog was a result of climate change. Mean scores for health effects showed that respiratory symptoms had the highest mean score (2.66), which was followed by eye/skin irritation, neurological/mental health issues, and general health effects (means ~2.35-2.40), while symptoms of heart disease had the lowest mean (1.86). Significant correlations were found between climate change perception, smog perception and preventive behavior in adults mixed to acceptable degrees across the domains of smog exposure and mental/general/heart health effects, however weak, or no correlation was found around knowledge level and health outcomes.

The high level of understanding (94.9%) and perception of smog risk (77.8%) demonstrates that urban residents of Lahore are well-informed to be aware of health risks associated with air pollution. These results correlate with evidence from existing literature grounded in Pakistan and South Asia that shows growing public awareness of air pollution, and its adverse health effects (Iram et al., 2025; JCPSP, 2024; MDPI Environments, 2024). However, the weak relationship between air pollution knowledge and self-reported health outcomes reinforces a well-known trend in environmental health research, that awareness alone is not effective in informational protection behavior or subsequent health (Air pollution, Pakistan, 2022; Khan, 2022). The ongoing "knowledge behavior health gap" reinforces the importance of addressing change tactics and support structural networks rather than only providing information.

The respiratory symptoms that are reported the most closely align with evidence that being exposed to ambient particulate matter ($PM_{2.5}$ and PM_{10}) is linked to increased risk of respiratory morbidity and mortality in Pakistan (Khetran, 2023; “Existing Smog in Lahore,” 2018). Additionally, with new studies showing more widespread neuropsychological and systemic consequences of air pollution, it is also striking that there are high rates of eye and skin irritation and neurological and mental health conditions, providing further evidence that the health burden of smog goes beyond traditional respiratory and cardiovascular mechanisms (Iqbal et al., 2023; Ashraf et al., 2024). Factors that may have contributed to the relatively low mean

score for heart disease symptoms include the sample being younger, the general population being unaware of the connections to cardiovascular effects, or the fact that cardiovascular impacts tend to be subclinical or chronic rather than showing immediate consequences (Cheema, 2014; Frontiers in Sustainable Cities, 2023).

The strong correlation between climate change perceptions and preventative behavior is particularly noteworthy. This indicates that those individuals who perceive smog as part of a larger climate and environmental context are more likely to adopt preventative behaviors like mask wearing, limiting outdoor activity or improving indoor air quality. These findings are consistent with previous behavioral science studies showing that risk perception and environmental framing influences preventative behavior (AQLI, 2024; Sustainability 2024). In terms of public health communication, reframing messages that emphasize a climate resilience aspect, especially in a city like Lahore where smog increasingly referred to as a "fifth season," may be useful since it is a consequence of local emissions and also regional agricultural burning (Sher Baz Khetran, 2023).

The ongoing health effects and moderately low uptake of preventive behavior, despite high awareness, suggest that socioeconomic and structural barriers are in place. Awareness of the risk appears to be translated to effective protection in a limited way due to the price of protection, limited access to air purifiers, insufficient environmental regulations, and lax enforcement, even in a relatively educated urban adult population. Previous research in Pakistan identifies environmental factors, educational attainment and socioeconomic status as having a significant impact on exposure and vulnerability to air pollution (Sustainability, 2024; ArXiv, 2025). These findings indicate a need for multi-level interventions that combine community level resilience strategies, policy enforcement, education, and improved infrastructure in order to mitigate the adverse health effects of smog in urban Pakistan.

CHAPTER 6:
CONCLUSIONS AND RECOMMENDATION

6.1 Recommendations

To encourage preventive measures against smog exposure, start ongoing, evidence-based campaigns and incorporate environmental health education in colleges and universities. Encourage green infrastructure projects like planting urban trees and using electric vehicles and enforce emission control laws more strictly. To assist citizens in making educated decisions about their health and activities, expand air quality monitoring systems and create real-time public alert platforms. Create programs for respiratory and mental health screenings during the smog season and educate medical professionals on how to promptly diagnose and treat smog-related illnesses.

.6.3 Future Research

Conduct longitudinal studies to assess chronic respiratory, cardiovascular, and psychological effects of prolonged smog exposure. Evaluate the impact of awareness, behavior change, and policy interventions on reducing health risks related to smog. Use predictive models to estimate future health burdens of smog under varying climate change and emission scenarios. Investigate disparities in smog exposure and health outcomes across different socioeconomic groups and major cities in Pakistan.

6.4 limitations

Research conducted through stratified sampling underrepresented certain group, including older adults, specific income levels and dimensional ethnicities. This study used self-reported questioner which may not be always accurate because people might give socially accepted answers. Data was collected in certain areas of Lahore. The questioner only checked basic knowledge and perception and did not track changes over time.

6.5 Conclusion

The current study represents most of the urban adult population in Lahore recognizes smog as an impact of climate change and demonstrates high awareness and perception about the negative health impact of smog. Cardiovascular symptoms were reported the least, but this is understood to be important epidemiologically. Respiratory symptoms were the most reported health impact, while skin and eye irritation were the next most reported health impact followed by neurological and mental health symptoms and general health alinements. strong correlations were identified between perception of smog, climate change, and protective behaviour, illustrating the relationship between environmental awareness and protective behavior. The knowledge behaviour health gap is a notable factor since there was week correlation between knowledge and health outcomes behaviour in other words, health risk associated with exposure cannot be reduced simply by knowing that tolerable levels are exceeded. Policy framing should specifically aim to improve air quality monitoring, utilise real time exposure data sharing, promote affordable price protective devices, and include climate resilience framing in health messaging. Future studies should incorporate more diverse samples, employ longitudinal designs, and evaluate the interventions that can provide structural mitigation along with behavioural modification. Overall, this work demonstrates the urgent need for evidence-based mechanisms to decrease the negative effects of smoke on health in Pakistani citizens, by converting awareness into actionable practice.

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Appendices

Appendix A: Structured questionnaire

Appendix B: Health Impact assessment checklist

Appendix C: Informed consent form

Appendix D: Ethical approval letter

Plagiarism Certificate

This is to certify that the research work entitled **"Assessment of Knowledge, Public Perception, and Health Impact of Smog Among Adults in Lahore",** submitted by Muniba Pervaiz, in partial fulfillment of the requirements for the degree of **Bachelor of Science in Public Health**, is an original piece of work carried out by the student. I further declare that this research work has not been submitted previously to any other university or institution for the award of any degree or diploma. All sources of information used in this research have been properly acknowledged and cited. The similarity index of this research work is within the acceptable limits as prescribed by the university policies.

Sidra Shahid

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Our system's algorithms look deeply at a document for any inconsistencies that would set it apart from a normal submission. If we notice something strange, we flag it for you to review.

A Flag is not necessarily an indicator of a problem. However, we'd recommend you focus your attention there for further review.

*% detected as AI

AI detection includes the possibility of false positives. Although some text in this submission is likely AI generated, scores below the 20% threshold are not surfaced because they have a higher likelihood of false positives.

Caution: Review required.

It is essential to understand the limitations of AI detection before making decisions about a student's work. We encourage you to learn more about Turnitin's AI detection capabilities before using the tool.

Disclaimer

Our AI writing assessment is designed to help educators identify text that might be prepared by a generative AI tool. Our AI writing assessment may not always be accurate (i.e., our AI models may produce either false positive results or false negative results), so it should not be used as the sole basis for adverse actions against a student. It takes further scrutiny and human judgment in conjunction with an organization's application of its specific academic policies to determine whether any academic misconduct has occurred.

Frequently Asked Questions

How should I interpret Turnitin's AI writing percentage and false positives?

The percentage shown in the AI writing report is the amount of qualifying text within the submission that Turnitin's AI writing detection model determines was either likely AI-generated text from a large-language model or likely AI-generated text that was likely revised using an AI paraphrase tool or word spinner.

False positives (incorrectly flagging human-written text as AI-generated) are a possibility in AI models.

AI detection scores under 20%, which we do not surface in new reports, have a higher likelihood of false positives. To reduce the likelihood of misinterpretation, no score or highlights are attributed and are indicated with an asterisk in the report (*%).

The AI writing percentage should not be the sole basis to determine whether misconduct has occurred. The reviewer/instructor should use the percentage as a means to start a formative conversation with their student and/or use it to examine the submitted assignment in accordance with their school's policies.

What does 'qualifying text' mean?

Our model only processes qualifying text in the form of long-form writing. Long-form writing means individual sentences contained in paragraphs that make up a longer piece of written work, such as an essay, a dissertation, or an article, etc. Qualifying text that has been determined to be likely AI-generated will be highlighted in cyan in the submission, and likely AI-generated and then likely AI-paraphrased will be highlighted purple.

Non-qualifying text, such as bullet points, annotated bibliographies, etc., will not be processed and can create disparity between the submission highlights and the percentage shown.