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Beyond the Smog: Unveiling the Invisible Toll of Air Pollution on the People's Mental Well-Being in Lahore, Pakistan

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ABSTRACT

Background: The manuscript investigates the significant detrimental impact of air pollution, particularly smog, on the mental health of residents in Lahore, Pakistan. Research highlights various ways in which pollutants contribute to mental health issues, including increased risks of depression and anxiety, and direct impacts on cognitive function.

Aims: This study aims to establish a link between air quality and its psychological impact on the inhabitants of Lahore. It seeks to advocate for effective interventions to mitigate the adverse effects of air pollution on mental health.

Methods: This study examined existing literature on the Internet to understand the link between air pollution and mental health. This manuscript aimed to provide a foundation for developing evidence-based solutions within the current healthcare landscape.

Results: Searching for "smog," "mental health," and "air pollution" yielded these results, a strong association between increasing levels of air pollution in Lahore and its impact on residents' mental well-being. Despite ongoing efforts to mitigate air pollution, the persistent smog burden in Lahore highlights the need for more effective and decisive interventions to improve air quality and safeguard the population's mental health.

Conclusion: This study serves as a preliminary investigation into the intricate relationship between air pollution and mental health. It emphasizes the need for further research to comprehensively understand this critical issue and proper policy implications and potential interventions are required to mitigate the adverse effects of air pollution on mental health.

1 | Introduction

Air pollution is now recognised as a major public health concern around the world. Smog, characterized as fog exacerbated or contaminated by smoke, compounds this issue. Psychological distress, encompassing emotional or mental discomfort that may culminate in anxiety, stress, and various mental health challenges, is a consequential outcome [1]. Indoor and outdoor air pollution is responsible for an estimated 6.9 million annual cases of premature mortality, according to the World Health Organisation. They estimate that 4.2 million people died prematurely in 2019 due to ambient (outdoor) air pollution. With the highest frequency recorded in the WHO South-East Asia and Western Pacific Regions, around 89% of these premature mortality occurred in low- and middle-income nations [2].

There are two main types of smog: photochemical smog and industrial smog. The photochemical smog is typically found in warm, sunny climates and is formed by the reaction of NOx and VOCs in the presence of sunlight. It is characterized by a brown

haze and can cause various health problems. The industrial smog is typically found in colder climates and is formed by burning fossil fuels for heating and industrial processes. It is characterized by a gray haze and can also cause health problems.

In South Asia, Pakistan stands as one of the most urbanized nations, with Lahore, its second-largest city, experiencing a steady annual growth rate of 4%. Regrettably, Lahore is not only Pakistan's most polluted city but also has a notorious global reputation. Like many urban areas in Asia, Lahore grapples with persistent smog issues. Every winter, the city is veiled by a distressingly dense layer of smog, significantly impacting the lives of its residents [3]. The literature analysis has emphasized the intricate interplay of elements contributing to smog formation, particularly in Lahore, due to a combination of causes such as emissions from vehicles, factories, and agricultural practices including burning crop leftovers [4].

This study seeks to clarify the substantial influence of air pollution on the mental health of inhabitants of Lahore, Pakistan. It aims to highlight the relationship between air quality and psychological impact and advocate for effective treatments to alleviate the detrimental impacts of air pollution on mental health. This study serves as an initial investigation into this critical issue, prompting further research to comprehensively understand the intricate relationship between air pollution and mental health.

2 | Challenges

World Bank data shows that outdoor air pollution is a leading cause of premature adult mortality in Pakistan, accounting for 22,000 fatalities and 163,432 lost DALYs annually. This data highlights the serious concern that air pollution poses in the country. NOx, O_3, and SO_2, which are primary pollutants, have experienced substantial growth over a span of two decades. Moreover, air quality in large urban areas often surpasses national standards. These concerning statistics emphasise the immediate requirement for more stringent rules and efficient strategies to alleviate the detrimental consequences of air pollution [5]. There are some clues in the numbers from the Punjab Cancer Registry and the Karachi Cancer Registry. In Pakistan, lung cancer accounts for an estimated 5% of all new cancer cases; it is the second most prevalent cancer in males and the third most common disease in both sexes overall [6].

Around the world, people are faced with substantial and persistent challenges related to mental health and air pollution. This emphasises how important it is to address each of these issues concurrently from a public health standpoint. Air pollution has a wide range of health effects. Even on days with moderate levels of air pollution, those who are prone to allergies and vulnerable can still experience negative impacts on their well-being. Short-term exposure to air pollution is significantly linked to COPD (Chronic Obstructive Pulmonary Disease), coughing, breathing difficulties, wheezing, asthma, respiratory disease, and a high rate of hospitalisation [7]. Air pollution has been associated with chronic asthma, pulmonary insufficiency, and cardiovascular problems as long-term consequences [8].

Researchers from the University of Oxford's Department of Psychiatry, as part of the funded BioAirNet programme, analysed previous studies on the effects of indoor and outdoor air pollution. Their findings indicate that exposure to air pollution may lead to mental health conditions, including anxiety, depression, psychoses, and neuropsychological problems such as dementia. Furthermore, there is evidence suggesting that air pollution might have an impact on the cognitive development of children and adolescents, who are in a crucial stage of brain maturation. This puts them at a heightened vulnerability to experiencing severe negative consequences and having significant mental health disorders in the future [9].

More than a hundred research on the impact of outdoor air pollution on the brain's emotional regulation regions—the prefrontal cortex, hippocampus, and amygdala—were analysed in a recent meta-analysis. Nearly three-quarters of the investigations indicated that animals and people exhibited more severe mental health symptoms and behaviours following exposure to air pollution levels above the usual [10]. Furthermore, a March 2023 study by Harvard researchers adds to the mounting data linking air pollution exposure to a higher risk of dementia, this pollution includes tiny particulate matter (PM2.5), nitrogen oxide, and nitrogen dioxide [11]. A research study into the effects of air pollution on college student's mental health was carried out in Lahore. The study revealed a favourable correlation between students' psychological discomfort levels and their perceptions of air pollution [12].

These findings emphasise the detrimental impact of air pollution on both physical health and mental well-being, underscoring the urgent necessity for comprehensive strategies to address air quality issues in Lahore. Implementing stringent regulations, effective tactics, and a holistic approach prioritising public health and welfare is essential to confront this complex challenge. The consequences of neglecting the gravity of this situation will be evident for years ahead.

3 | Recommendations

A strategic and concerted effort is required to comprehensively address the mental health impact of smog in Lahore. A critical starting point involves enhancing the air quality monitoring systems. Pakistan lacks sufficient public air quality monitoring stations, and the accessibility of real-time data from the existing network is uncertain. Most available data comes from low-cost detectors managed by private users and nongovernmental organizations. To address this issue, there is a critical need to establish a comprehensive statewide monitoring infrastructure with improved data granularity and expanded coverage in multiple cities [13]. This can be achieved by investing in advanced technologies to strengthen and expand the current infrastructure, enabling real-time tracking of pollutant levels for accurate air quality assessments.

Establishing an effective early warning system holds significant importance. To guarantee broad dissemination and awareness, this system must swiftly convey air-quality information to the public through diverse channels, including mobile apps, social media, and traditional media outlets. The goal is to empower

individuals to adjust their behavior, such as choosing the right time for outdoor activities, to safeguard both their health and the overall quality of the air they inhale [14]. It is crucial to strictly enforce the existing regulations and adopt new measures to control industrial emissions, vehicular pollution, and other sources contributing to smog [15]. It is also important to intensify public awareness campaigns to educate residents about the adverse effects of vehicular and industrial emissions on air quality and, consequently, mental health. Encouraging public participation in reporting violations can lead to collective efforts toward achieving cleaner air [16].

Green urban planning is an essential element in creating a healthier environment. Incorporating green spaces into urban planning serves as natural air purifiers, contributing to overall well-being [17]. Furthermore, promoting sustainable transportation options such as public transport, cycling, and electric vehicles is critical. Implementing policies that encourage the adoption of environmentally friendly transportation options reduces air pollution and fosters a sustainable and health-conscious urban lifestyle [18]. Additionally, strict enforcement and enhancement of regulations are necessary to reduce pollutant emissions and mitigate the impact on mental health.

Similarly, promoting the use of renewable energy sources—like solar and wind power—is a proactive approach to reducing air pollution. Transitioning to cleaner energy alternatives addresses environmental concerns and contributes to mental well-being. Offering incentives to industries and households that adopt environmentally friendly practices encourages a collective shift towards cleaner and sustainable energy options [19]. A comprehensive approach to mitigating the mental health impacts of smog involves integrating mental health services into the existing healthcare infrastructure. This can be achieved by incorporating mental health assessments into primary healthcare services and training healthcare professionals to recognize and address mental health issues related to air pollution [20]. To ensure accessible support and counselling services for individuals affected by smog-related mental health challenges, community-based mental health centers should be established in Lahore. During peak smog periods, emergency response plans should be developed and shared with healthcare facilities to ensure that healthcare professionals can handle increased mental health cases during such crises.

Raising awareness of the negative effects of smog on mental health can also be accomplished through educational programmes. Integrating environmental and mental health education into school curricula can equip the younger generation with essential knowledge [21]. Workshops and community awareness campaigns can further emphasize the link between smog and mental health, providing practical tips for reducing exposure and coping with associated stress.

To inform targeted interventions and policies, it is crucial to conduct longitudinal studies on the specific mental health impacts of smog in the city [22]. Collaborations between government bodies, research institutions, and nongovernmental organizations can foster ongoing research efforts and ensure that the mental health effects of air pollution are continuously monitored and studied [23].

It is crucial to involve local communities in decision-making processes related to air quality management for sustained progress. Encouraging grassroots initiatives that promote cleaner environments and mental well-being ensures that efforts are driven by the community. Launching advocacy campaigns involving celebrities, influencers, and community leaders amplifies the message of air quality and mental health awareness, fostering a sense of shared responsibility [24]. We may strive towards constructing a stronger and healthier community by executing these suggestions and recognising the complex nature of the problem. This approach strives not only to clear the skies above Lahore of smog but also to alleviate the shadows cast on the mental well-being of its residents.

Author Contributions

Sidra Irfan: conceptualization, writing – original draft. **Muhammad Muzzamil:** methodology, writing – review and editing. **Nusrat Tahira:** supervision, writing – original draft. **Beenish Altaf:** Writing – review and editing, writing – original draft. **Farwa Fatima:** writing – original draft, writing – review and editing. **Abdullah Malikzai:** writing – review and editing.

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