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PUBLIC PERCEPTION OF AIR POLLUTION EXPOSURE AND HEALTH IMPACTS IN CENTRAL DELHI

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Abstract:

Residents of Delhi are exposed to elevated air pollution levels for extended periods each year, particularly in densely trafficked central urban areas. This study examines public perception of air pollution exposure, associated health discomfort, and awareness of preventive practices in Central Delhi. Primary data were collected through a structured questionnaire survey involving 36 respondents via Google Form circulation, supported by direct field interactions within the study area. The responses indicate frequent experiences of breathing difficulty, coughing, and irritation during high pollution episodes, with winter identified as the most problematic season for residents of Delhi. Although awareness of pollution sources and related health risks was widespread, the adoption of household-level protective measures such as air purifiers remained limited. The findings reveal a gap between awareness and practical mitigation among urban residents. By presenting localized perception-based evidence, the study provides insights relevant to public health planning and urban air quality management in Delhi

Keywords: Air pollution, Public perception, Health impacts, Central Delhi, Questionnaire survey

1. Introduction

Air pollution continues to be one of the most serious environmental challenges affecting urban areas worldwide, particularly in rapidly developing countries such as India. Major urban centers like Delhi frequently experience high levels of air pollution due to vehicular emissions, construction activities, industrial processes, population growth, and unfavorable meteorological conditions. Reports from national and international monitoring agencies consistently show that air quality levels in Delhi often exceed permissible limits, posing significant risks to public health and environmental sustainability.

Particulate matter, especially $PM_{2.5}$ and PM_{10}, has been identified as a major contributor to adverse health effects. Prolonged exposure to high concentrations of particulate matter is associated with respiratory problems, cardiovascular diseases, reduced lung function, and increased mortality. The World Health Organization (WHO) and the Central Pollution Control Board (CPCB) have repeatedly emphasized the need for urgent action to control air pollution in Indian cities, with Delhi often cited as a high-risk urban region.

While air quality monitoring stations provide quantitative data on pollutant concentrations, understanding **public perception and lived experiences** is equally important. Perception-based studies help capture how people experience air pollution in their daily lives, including symptoms such as breathing difficulty, eye irritation, and general discomfort. Such studies are particularly relevant in urban settings where exposure is continuous and unavoidable for many residents.

Central Delhi represents a significant urban zone characterized by dense traffic, administrative activities, commercial areas, and tourist locations. Areas such as the India Gate region experience high vehicular movement and public footfall, making them relevant for

assessing both exposure and public response to air pollution. Residents and visitors in this region are frequently exposed to polluted air, especially during winter months when atmospheric conditions limit pollutant dispersion.

This study attempts to examine public perception of air pollution, associated health impacts, and awareness of preventive measures in Central Delhi using a questionnaire-based survey. By combining survey data with qualitative field observations, the study seeks to provide insight into how urban residents perceive air quality and how these perceptions align with existing air pollution trends reported by government agencies. The findings may contribute to a better understanding of public experiences and support the development of more effective, people-centered air quality management strategies.

2. Literature Context

Air pollution in Delhi has been examined extensively in both scientific reports and government publications. Over the years, multiple monitoring agencies have documented recurring episodes of severe air quality deterioration, especially during winter. Studies consistently indicate that particulate matter remains the primary pollutant of concern in Delhi, largely due to transport emissions, road dust resuspension, construction activity, and seasonal atmospheric conditions.

Beyond technical monitoring, researchers have increasingly emphasized the importance of understanding how people experience pollution in everyday life. While air quality data provide numerical indicators, public perception reflects the lived reality of exposure. Individuals often interpret pollution through physical discomfort such as irritation in the eyes, difficulty in breathing, or persistent coughing. These experiences influence behavioural responses, including the use of masks, avoidance of outdoor activity, or changes in daily routines.

Previous perception-based studies in urban India have shown that awareness of air pollution is generally high among residents. However, awareness does not always translate into consistent protective behaviour. Economic constraints, limited access to clean technologies, and adaptation to long-term exposure often reduce active mitigation at the household level. This gap between knowledge and practice remains a significant policy challenge.

By focusing specifically on Central Delhi, the present study contributes a localized understanding of how residents perceive air pollution in a high-traffic and administratively significant urban zone. This localized evidence complements broader regional studies and helps connect statistical air quality trends with personal experience.

In recent years, Air Quality Index (AQI) reports released during 2023–2024 have continued to classify Delhi's air quality as "poor" or "very poor," particularly during the winter season. Despite various control measures and policy efforts, noticeable improvement has remained limited. When these reported levels are compared with the updated guidelines of the World Health Organization, particulate matter concentrations in Delhi still exceed recommended limits by a considerable margin. These ongoing trends highlight that air pollution in Delhi is not a short-term issue but a continuing environmental concern. Therefore, examining how residents perceive and respond to such conditions becomes increasingly important in understanding the broader social impact of air pollution.

3. Study Area

The present study was conducted in **Central Delhi**, an important urban region of the National Capital Territory of Delhi, India. Central Delhi is characterized by high population density, intense vehicular traffic, commercial activities, government offices, and prominent public spaces. Due to these characteristics, the region experiences continuous exposure to air pollutants, making it a suitable area for assessing public perception of air pollution and its associated health impacts.

Central Delhi includes several high-traffic zones and public landmarks, such as the India Gate area, which attracts a large number of daily commuters, tourists, and local residents. The high vehicular movement in this region contributes significantly to emissions of particulate matter and gaseous pollutants. In addition, ongoing construction and urban development activities further add to dust and suspended particulate levels in the ambient air.

Climatically, Delhi experiences extreme seasonal variations, with winter months often associated with temperature inversion conditions that restrict vertical dispersion of pollutants. As a result, air quality in Central Delhi tends to deteriorate significantly during winter, leading to prolonged episodes of smog and elevated pollution levels. These conditions make the region particularly vulnerable to air pollution-related health risks.

The selection of Central Delhi as the study area allows for the assessment of air pollution perception in a highly exposed urban environment. The findings from this area are relevant for understanding public experiences in similar metropolitan regions and can support localized air quality management and public health interventions.

4. Methodology

This study adopted a perception-based descriptive research approach to assess public exposure to air pollution, associated health impacts, and awareness levels in Central Delhi. Primary data were collected through a structured questionnaire survey, supplemented by qualitative field observations.

4.1 Questionnaire Survey

A structured questionnaire was designed using **Google Forms** to collect information on respondents' perception of air quality, experienced health symptoms, awareness of pollution sources, and adoption of preventive measures such as mask usage and air purifiers. The questionnaire consisted of multiple-choice and close-ended questions to facilitate easy participation and quantitative analysis.

The survey was circulated online, and a total of **36 valid responses** were received. Participation was voluntary, and responses were collected anonymously. The sample represents adult residents and individuals frequently exposed to the urban environment of Central Delhi. Although the sample size is limited, it is considered adequate for a perception-based exploratory study at the local level.

4.2 Field Interaction and Qualitative Observation

In addition to the online survey, **informal field interactions** were conducted in Central Delhi, particularly in public areas such as the India Gate region. These interactions were aimed at understanding general public experiences and concerns related to air pollution, including breathing difficulty, odour in the air, and overall discomfort during periods of high pollution. The observations were qualitative in nature and were used to support and contextualize the survey findings rather than as quantified data.

4.3 Data Analysis

The collected survey data were exported to a spreadsheet format and analysed using **descriptive statistical methods**. Responses were summarized using frequencies and percentages, and results were presented in the form of tables and graphical representations where appropriate. The analysis focused on identifying dominant perceptions, commonly reported health issues, and awareness levels regarding air pollution and its sources.

5. Results and Discussion

While the sample size is limited, the consistency observed across responses provides useful insight into public perception patterns within the study area.

The results of the questionnaire survey provide valuable insights into public perception of air pollution exposure, health impacts, and awareness levels in Central Delhi. The findings are discussed below in relation to existing air quality conditions and reported trends.

5.1 Perception of Air Quality

The survey responses suggest that a majority of respondents perceive the ambient air quality in their area as poor to very poor. This perception reflects the persistent air pollution problem in Delhi, particularly in high-traffic urban zones. Public dissatisfaction with air quality suggests continuous exposure to polluted air and aligns with reported high Air Quality Index (AQI) values in Central Delhi as recorded by government monitoring agencies.

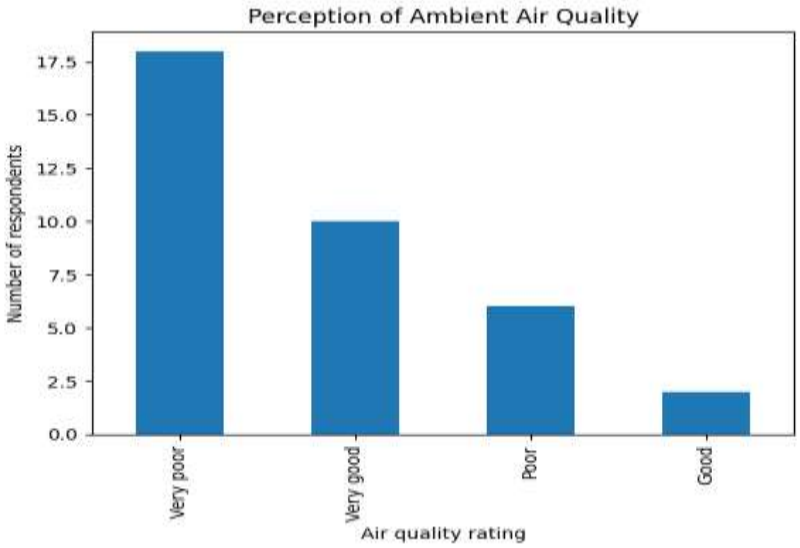

Figure 1: Perception of Ambient Air Quality among Respondents in Central Delhi

In addition to rating the air quality as poor, several respondents informally expressed that pollution has become a "normal part" of city life. This normalization of environmental risk is noteworthy. When poor air quality becomes routine, individuals may adjust psychologically rather than demand structural change. Such adaptation does not reduce health risk but may reduce urgency in collective response. Understanding this subtle behavioural dimension is important for effective policy communication.

5.2 Seasonal Variation in Air Pollution

A significant proportion of respondents identified **winter** as the season with the worst air quality. This observation is consistent with official air quality reports, which indicate that winter months in Delhi are characterized by temperature inversion, low wind speed, and reduced atmospheric dispersion. These conditions lead to the accumulation of pollutants, resulting in prolonged smog episodes and degraded air quality.

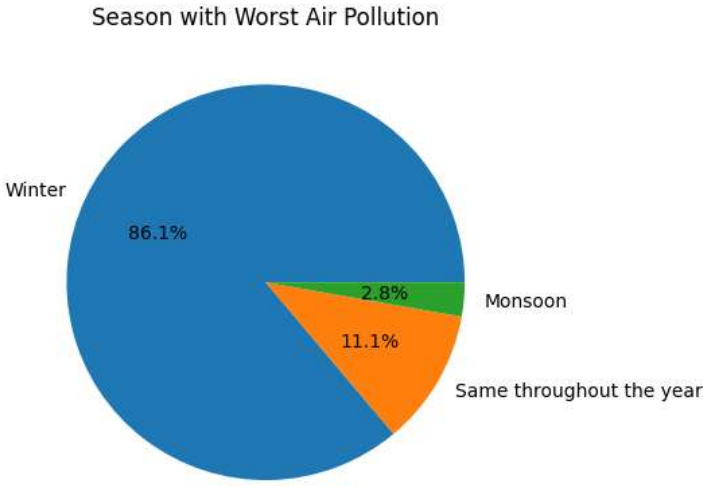

Figure 2: Seasonal variation in perceived air pollution levels

5.3 Health Impacts Experienced by Respondents

Health-related responses reveal that a large share of participants experience **breathing difficulties**, coughing, and irritation of the eyes and throat, either often or sometimes. These self-reported symptoms highlight the direct impact of air pollution on daily life and well-being. Similar health effects have been widely documented in studies conducted in Delhi and other polluted metropolitan regions, particularly in relation to prolonged exposure to particulate matter ($PM_{2.5}$ and PM_{10}).

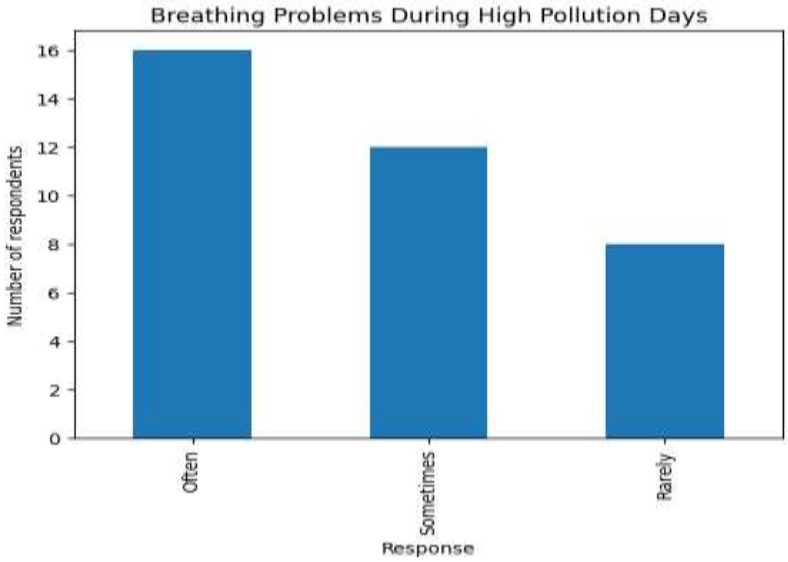

Figure 3: Health problems experienced by respondents due to air pollution

The qualitative field interactions conducted in Central Delhi further supported these findings, as many individuals expressed discomfort while breathing, a sense of heaviness in the air, and the presence of unpleasant odours, especially during high pollution periods. These lived experiences reinforce the quantitative survey results and demonstrate the real-world impact of air pollution on urban populations. Although this study is based on self-reported responses rather than medical examination, the consistency of reported symptoms across participants suggests genuine exposure-related discomfort. Even mild but repeated irritation can affect productivity, concentration, and overall well-being. For individuals commuting daily through congested areas of Central Delhi, such exposure is not occasional but continuous, reinforcing the need for preventive urban planning.

5.4 Awareness and Preventive Measures

The survey responses indicate a moderate level of awareness regarding air pollution sources and associated health risks. Vehicular emissions were perceived as the major contributor to air pollution, followed by industrial activities and construction dust. This perception corresponds with emission source apportionment studies conducted by government agencies, which identify transport and dust as key contributors to urban air pollution in Delhi.

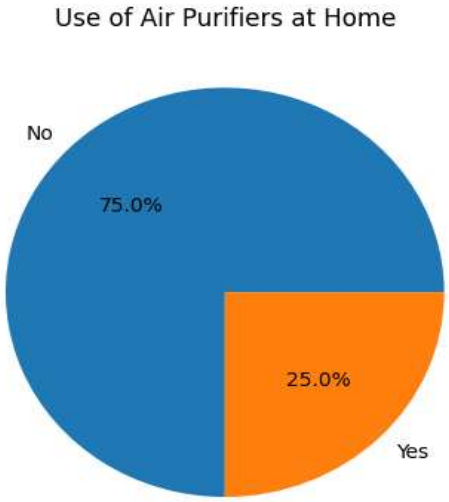

Figure 4: Adoption of preventive measures against air pollution

Despite awareness of air pollution and its health effects, a majority of respondents reported **not using air purifiers**. This indicates a gap between awareness and the adoption of effective indoor mitigation measures. Factors such as high cost, limited access, or lack of perceived necessity may contribute to this gap. Mask usage was reported by many respondents, although not consistently by all participants, suggesting partial adoption of protective behaviour.

It is also possible that some respondents rely more on short-term coping strategies, such as limiting outdoor exposure during visibly polluted days, rather than investing in technological solutions. This behavior reflects practical decision-making shaped by income levels, housing conditions, and personal risk perception. Policy responses must therefore address both structural emission control and accessible household-level guidance.

5.5 Comparison with Official Air Quality Reports

The public perception documented in this study is broadly consistent with data published by the Central Pollution Control Board (CPCB) and other government agencies, which frequently classify Delhi's air quality as poor or very poor during significant parts of the year. The convergence of public perception, survey responses, and official monitoring data strengthens the reliability of the study findings.

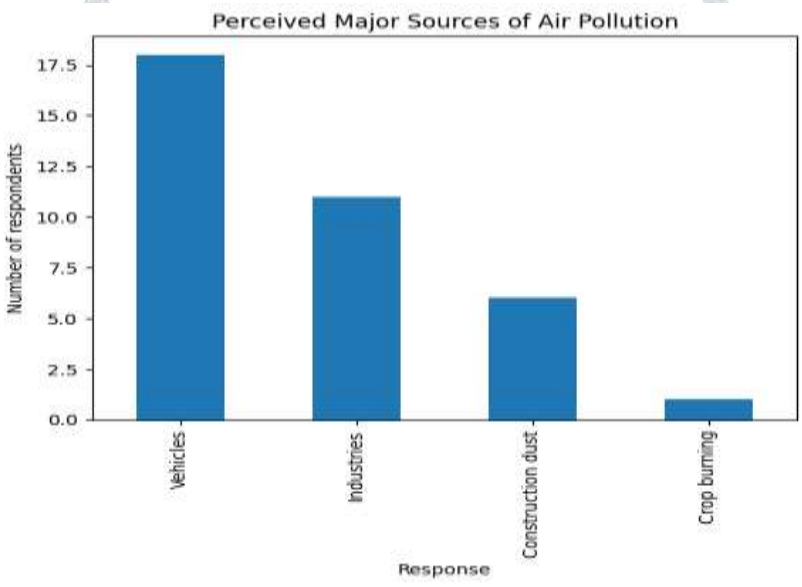

Figure 5: Perceived major sources of air pollution in Central Delhi

Overall, the results highlight the widespread exposure of urban residents to air pollution in Central Delhi and emphasize the need for improved pollution control measures, increased public awareness, and accessible mitigation strategies to reduce health risks.

6. Conclusion

This study assessed public perception of air pollution exposure, associated health impacts, and awareness levels in Central Delhi using a questionnaire-based survey supported by qualitative field observations. The results demonstrate that air pollution remains a significant environmental and public health concern in the study area. Most respondents perceived air quality as poor or very poor, with winter identified as the most polluted season. Breathing difficulties, coughing, and irritation of the eyes and throat were commonly reported, reflecting the tangible impact of degraded air quality on daily life.

Despite general awareness of air pollution and its sources, the study revealed a significant gap between awareness and the adoption of effective preventive measures. The limited use of air purifiers among respondents highlights issues related to accessibility, affordability, and practical implementation of indoor air quality control measures. Public perception identified vehicular emissions and construction activities as major contributors to air pollution, which aligns with findings from official air quality monitoring agencies.

Based on the findings, several policy-oriented recommendations are suggested. Strengthening vehicular emission control through improved public transport, promotion of electric vehicles, and stricter enforcement of emission norms can help reduce pollution levels. Effective regulation of construction activities and dust control measures should be prioritized in urban areas. Public awareness programs should not only focus on pollution severity but also promote practical and affordable mitigation strategies for households. Additionally, expansion of air quality monitoring networks and timely dissemination of air quality information can help residents make informed decisions to reduce exposure.

Importantly, perception-based findings such as those presented in this study highlight the human dimension of environmental degradation. Air pollution is not only an atmospheric measurement but also a lived experience that shapes daily comfort, health concerns, and urban behaviour. Incorporating public perception into environmental planning can help design interventions that are both technically sound and socially responsive.

Overall, the study emphasizes the importance of incorporating public perception into air quality management strategies. Understanding the experiences and concerns of urban residents can support more inclusive, people-centered policies aimed at improving air quality and protecting public health in metropolitan regions like Central Delhi.

7. Limitations of the Study

Like any perception-based research, the present study has certain limitations. The sample size was limited to 36 respondents, which may not fully represent the diverse population of Delhi. The study relied primarily on self-reported responses, which are subject to personal perceptions and may vary among individuals. In addition, the survey was conducted over a limited time period and focused on Central Delhi, which restricts the generalization of results to other regions.

The field interactions conducted during the study were qualitative in nature and were not quantitatively measured. Despite these limitations, the study provides meaningful insights into public perception of air pollution and associated health impacts in a highly exposed urban environment. The findings can serve as a basis for future studies with larger sample sizes and more extensive spatial coverage.

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