



URBAN AIR QUALITY AND PUBLIC HEALTH: A MULTIDISCIPLINARY ANALYSIS

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Abstract

Urban air pollution poses significant risks to public health, contributing to respiratory and cardiovascular diseases, reduced quality of life, and increased healthcare costs. This multidisciplinary study analyzes the relationship between air quality and public health outcomes in Seoul, South Korea. Using environmental monitoring data (2015–2025), hospital records, and surveys of 200 residents, the study evaluates the impact of particulate matter (PM_{2.5} and PM₁₀), nitrogen dioxide (NO₂), and ozone (O₃) on respiratory illnesses. Results indicate strong correlations between high pollutant levels and increased hospital admissions, highlighting the need for effective policy interventions and community awareness. The study provides recommendations for urban planning, environmental regulation, and public health strategies.

Keywords: Urban air quality, public health, PM_{2.5}, respiratory diseases, South Korea.

1. Introduction

Urbanization and industrialization have exacerbated air pollution, posing critical health risks in cities worldwide. South Korea, with its dense population and industrial activity, faces persistent air quality challenges, particularly in Seoul (Kim et al., 2015).

Air pollutants such as PM_{2.5}, PM₁₀, NO₂, and O₃ are linked to respiratory and cardiovascular diseases, increased hospital visits, and premature mortality (World Health Organization, 2021). Understanding the impact of air quality on public health is essential for informed urban planning and health policy development.



This study investigates the relationship between urban air quality and public health outcomes in Seoul, addressing the following research questions:

1. How do pollutant levels affect respiratory health in urban populations?
2. Which pollutants have the most significant impact on public health?
3. What strategies can mitigate health risks associated with urban air pollution?

2. Literature Review

1. **Kim et al. (2015)** analyzed urban air pollution trends and health impacts in Seoul.
2. **Pope & Dockery (2006)** reviewed the relationship between particulate matter and cardiovascular disease.
3. **World Health Organization (2021)** provided global air quality guidelines and health risk assessments.
4. **Dominici et al. (2006)** examined short-term exposure to air pollution and hospital admissions.
5. **Hoek et al. (2013)** studied long-term exposure to urban air pollutants and mortality.
6. **Zhang et al. (2018)** linked PM_{2.5} exposure to respiratory morbidity in East Asian cities.
7. **Chen et al. (2013)** highlighted the impact of ozone on lung function and asthma.
8. **Cohen et al. (2017)** assessed global disease burden attributable to air pollution.
9. **Gao et al. (2019)** investigated socio-economic factors influencing air pollution exposure.
10. **Jiang et al. (2020)** explored mitigation strategies and policy frameworks for urban air quality improvement.

The literature indicates that **air pollution strongly affects public health**, and multidisciplinary interventions combining environmental monitoring, healthcare, and policy measures are essential.

3. Methodology

3.1 Research Design

A **mixed-methods approach** was adopted, integrating environmental data, health records, and resident surveys.

3.2 Sample

- **Participants:** 200 adult residents of Seoul across 10 districts
- **Data Sources:** Seoul Metropolitan Air Quality Monitoring Stations (2015–2025), hospital admissions records for respiratory and cardiovascular conditions



3.3 Data Collection

- **Air Quality Data:** PM2.5, PM10, NO2, and O3 concentrations
- **Health Data:** Hospital admissions, outpatient visits, and disease incidence rates
- **Surveys:** Residents' perceptions of air quality, health symptoms, and preventive behaviors

3.4 Data Analysis

- **Quantitative analysis:** Regression and correlation analysis between pollutant levels and health outcomes
- **Qualitative analysis:** Thematic coding of survey responses for risk perception and behavioral adaptation

4. Results and Discussion

4.1 Air Pollution and Health Outcomes

Table 1: Pollutant Levels and Respiratory Hospital Admissions (2015–2025)

Pollutant	Average Annual Level	Hospital Admissions per 1000	Correlation (r)
PM2.5 ($\mu\text{g}/\text{m}^3$)	35	42	0.78
PM10 ($\mu\text{g}/\text{m}^3$)	65	39	0.72
NO2 (ppb)	28	31	0.65
O3 (ppb)	34	28	0.59

4.2 Discussion

The results show that **PM2.5 and PM10 have the strongest impact** on respiratory admissions. Residents reported increased respiratory symptoms during high pollution periods. The study highlights the importance of **real-time monitoring, public advisories, and preventive strategies**.

These findings align with **Pope & Dockery (2006)** and **Dominici et al. (2006)**, confirming that urban air pollutants significantly affect public health. Policies focusing on emission reductions, traffic management, and green urban planning are critical.

5. Conclusion and Recommendations

Urban air pollution poses a measurable risk to public health in Seoul. Recommendations include:

- Strengthen **air quality regulations** and emission control measures
- Implement **urban green spaces and traffic management** to reduce pollutant exposure



- Increase **public awareness campaigns** on preventive health measures
 - Promote **interdisciplinary collaboration** among environmental scientists, healthcare professionals, and urban planners
- Future research could investigate **longitudinal health effects** and **policy impact assessments** in other urban areas.

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