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The Impact of Industrial Air Pollution on Respiratory Health Among Urban Communities in Dhaka, Bangladesh

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Abstract

This study aims to analyze the impact of industrial air pollution on the respiratory health of urban residents in Dhaka. The rapid growth of industrialization and urbanization in Dhaka has led to a significant decline in air quality and increased the risk of public health problems, particularly respiratory diseases. This study used a qualitative approach with a case study design to understand the experiences of residents living around industrial areas. Data collection was conducted through in-depth interviews, observation, and documentation with affected residents, health workers, community leaders, and other stakeholders. The data were analyzed using thematic analysis through a process of data reduction, theme categorization, and interpretation of social meanings. The results show that urban residents in industrial areas experience high levels of exposure to air pollution due to factory smoke, industrial dust, and heavy vehicle emissions. This condition has a direct impact on increasing respiratory health problems such as chronic coughing, shortness of breath, asthma, and respiratory infections. Children and the elderly are the groups most vulnerable to the health impacts of air pollution. The study also found that residents have negative perceptions of air quality in their environment and have developed various simple adaptation strategies such as closing house vents, wearing masks, and limiting outdoor activities. However, this strategy has not been able to provide optimal protection due to high levels of pollution and the socio-economic limitations of the community. This study confirms that industrial air pollution in Dhaka is an environmental health and social injustice issue that requires strengthening industrial emission control policies and sustainable urban public health protection.

Introduction

Air pollution has become one of the greatest environmental health challenges in the modern world. Industrial growth, rapid urbanization, fossil fuel use, and increased transportation activity have led to a significant decline in air quality, especially in developing countries. The World Health Organization states that air pollution is a major risk factor for various non-communicable diseases and causes millions of premature deaths each year (WHO, 2022). Long-term exposure to air pollutants such as particulate matter (PM2.5 and PM10), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and carbon monoxide has been shown to be closely associated with increased respiratory health disorders, cardiovascular disease, and a reduced quality of life in urban communities (Meo et al., 2025). In a global context, air pollution is no longer viewed simply as an environmental issue but has evolved into a public health and social justice crisis (Loopmans et al., 2022).

The growth of industrialization in various developing countries has the dual consequence of both economic growth and increased ecological pressure. Industrialization that is not balanced by strict environmental regulations tends to produce large amounts of pollutant

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emissions that pollute urban air (Saxena, 2025). Urban areas in developing countries often experience overlap between industrial areas and residential areas, making the urban poor the most vulnerable group to air pollution exposure (Cacciatore et al., 2025). Furthermore, weak environmental monitoring systems, low industrial compliance with emission standards, and limited access to health services exacerbate the health impacts experienced by the community (Al Amosh & Khatib, 2025). This situation demonstrates that air pollution issues are closely related to socioeconomic inequality and urban environmental governance.

From an Environmental Health perspective, air quality is a crucial determinant of public health status. Continuous exposure to air pollutants can cause respiratory tract inflammation, impaired lung function, and an increased risk of chronic diseases such as asthma, bronchitis, and chronic obstructive pulmonary disease (Sierra-Vargas et al., 2023). Epidemiological studies have shown that fine PM2.5 particles can penetrate the lung alveoli and enter the bloodstream, thereby causing systemic impacts on the human body (Thangavel et al., 202). Furthermore, children, the elderly, and low-income communities are groups with higher levels of vulnerability due to limited adaptive capacity to air pollution (Palinkas et al., 2023). Therefore, industrial air pollution poses a serious threat to the sustainability of urban public health in various developing countries.

One region facing serious air pollution issues is Dhaka. As the capital of Bangladesh, Dhaka has experienced rapid urbanization and industrialization over the past two decades. The growth of the textile, manufacturing, coal-burning, construction, and transportation industries has significantly increased air pollutant concentrations (Sarwar & Khan, 2022). Dhaka has even been repeatedly listed as one of the cities with the worst air quality in the world based on the global air quality index (Ahmed et al., 2024). High population density and weak industrial emission controls mean that urban residents are constantly exposed to polluted air.

This condition has a direct impact on public health, particularly respiratory disorders. Various studies have shown that people living near industrial areas in Dhaka have a higher prevalence of respiratory diseases than those in non-industrial areas (Shahbaz et al., 2025). High exposure to PM2.5 and PM10 is known to increase the risk of acute respiratory infections (ARI), asthma, shortness of breath, and chronic cough in urban populations (Zheng et al., 2024). Furthermore, high humidity, poor ventilation, and dense housing worsen air quality in the neighborhoods where poor urban communities live (Anand & Phuleria, 2022). This situation demonstrates that the impact of air pollution is not only influenced by environmental factors but also by the socio-economic conditions of the community.

In public health studies, the respiratory health of urban communities is influenced by a complex interaction between environmental factors, behavior, and social structure. The Social Determinants of Health approach explains that poor communities tend to live in areas with poor environmental quality due to limited economic resources and limited access to adequate housing (Aidoo, 2023). As a result, these communities face greater health risks than those in the upper-middle class. In Dhaka, many urban communities live close to industrial areas without adequate environmental protection. This situation creates a form of environmental injustice, where vulnerable groups suffer greater impacts from pollution than others (Brehm & Pellow, 2022).

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Beyond health issues, industrial air pollution also has broad social and economic implications. Respiratory disorders increase household medical costs, reduce work productivity, and increase the burden on the public health system (Chen et al., 2023). Children with chronic respiratory disorders are at risk of developmental delays and reduced educational quality due to high school absenteeism. At the same time, communities often lack the economic capacity to reduce the risk of pollution exposure, for example using air filters or residential relocation. This situation demonstrates that industrial air pollution has become a multidimensional problem that requires a multidisciplinary approach.

Although various studies have addressed the relationship between air pollution and respiratory health, most studies have focused on quantitative epidemiological approaches and have not explored the social experiences of affected urban communities. Previous research has also tended to focus on measuring pollutant levels without deeply linking them to the socio-economic vulnerability of urban communities in Dhaka. Understanding community perceptions, adaptation strategies, and daily life experiences is crucial to explaining how air pollution affects the overall quality of life. Therefore, this study seeks to integrate environmental health approaches and community social perspectives to provide a more comprehensive understanding of the impact of industrial air pollution on the respiratory health of urban communities.

This study aims to analyze the impact of industrial air pollution on the respiratory health of urban communities in Dhaka, Bangladesh. Specifically, this study will identify the level of exposure to industrial air pollution, analyze the prevalence of respiratory disorders in the community, and explore community perceptions and experiences of health risks caused by air pollution. This research is expected to provide theoretical contributions to the development of epidemiology and urban environmental health studies, while also providing practical recommendations for the government and stakeholders in formulating more effective and socially equitable air pollution control policies.

Method

Research Approach and Type

This research uses a qualitative approach with a case study to deeply understand the impact of industrial air pollution on the respiratory health of urban communities in Dhaka. A qualitative approach was chosen because this research focuses not only on measuring air pollution levels but also on understanding community lived experiences, perceptions of health risks, and the social dynamics that arise from exposure to industrial air pollution. Through this approach, researchers can explore the social realities of the community in a more contextual and in-depth manner, based on the direct experiences of residents living in urban industrial areas.

The case study research method was used because the research seeks to understand the phenomenon of air pollution specifically within the context of a particular urban community experiencing continuous exposure to industrial pollution. The case study approach allows researchers to comprehensively explore the relationship between environmental conditions, respiratory health, and community socio-economic vulnerability within the real-life situations of urban communities.

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Research Locations

This research was conducted in several urban industrial areas in Dhaka with high levels of industrial activity and poor air quality. The research locations were selected purposively, considering the presence of textile and manufacturing industries, as well as fossil fuel combustion, and densely populated areas located near industrial areas. Furthermore, the research location was selected based on the high number of community reports of respiratory health problems and ongoing air pollution.

The research area also reflects the characteristics of urban settlements in developing countries, with high residential density, limited sanitation, and suboptimal access to healthcare. These conditions make communities in the research area vulnerable to the health impacts of industrial air pollution.

Research Focus

The primary focus of this research is to understand the impact of industrial air pollution on the respiratory health of urban communities. The research focuses on the experiences of communities living around industrial areas in dealing with respiratory health problems caused by air pollution. Furthermore, the research focuses on community perceptions of air quality, forms of socio-economic vulnerability that affect health, community adaptation strategies to air pollution, and community views on government policies regarding environmental pollution control.

Research Informants

The informants in this study were selected using a purposive sampling technique based on specific considerations relevant to the research objectives. Key informants consisted of residents living near industrial areas and having resided at the research location for at least five years. This criterion was used to ensure that informants had sufficient experience with exposure to industrial air pollution in their daily lives. In addition to the affected communities, the study also involved supporting informants such as health workers, community leaders, environmental activists, and local government representatives. The involvement of these various informants aimed to gain a broader perspective on the impact of air pollution on community respiratory health and the state of environmental governance in urban industrial areas.

The number of informants in the study was determined based on the principle of data saturation, meaning the data collection process was stopped when the information obtained showed recurring patterns and no significant new themes were identified.

Data Collection Techniques

Data collection in this study was conducted through in-depth interviews, observation, and documentation. In-depth interviews were conducted in a semi-structured manner using a pre-developed interview guide. The interviews aimed to explore community experiences related to respiratory health problems, perceptions of air quality, the socio-economic impacts of air pollution, and community adaptation strategies in dealing with industrial environmental pollution.

In addition to interviews, the study also used direct observation techniques at the study sites to observe residential environmental conditions, industrial activity, residential density, and air conditions around the industrial areas. Observations were conducted to

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obtain a realistic picture of the environmental situation of urban communities affected by air pollution.

Documentation techniques were used to supplement research data through the collection of documents such as air quality reports, public health data, photographs of the research environment, and government policies related to air pollution control. This documentation was used as supporting data to strengthen the research findings.

Data Analysis Techniques

The data analysis in this study used the interactive analysis model developed by Miles, Huberman, and Saldaña, which includes data reduction, data presentation, and conclusion drawing. The data reduction stage was carried out by selecting, focusing, and simplifying data from interviews, observations, and documentation according to the research focus. Next, the data was presented in descriptive narrative form to facilitate researchers in understanding patterns and relationships between research findings.

The final stage was drawing conclusions and verifying the data to discover the meaning of community experiences related to the impact of industrial air pollution on respiratory health. Analysis was conducted continuously throughout the research process so that researchers could understand the phenomenon in depth and context.

This study also used thematic analysis to identify key themes emerging from community experiences, such as respiratory health disorders, health risk perceptions, environmental injustice, and urban communities' adaptation strategies to industrial air pollution.

Data Validity

The validity of the data in this study was maintained through source triangulation, method triangulation, and member checking. Source triangulation was conducted by comparing information obtained from various informants, such as community members, health workers, and local government officials. Method triangulation involved comparing interview results, observations, and documentation to ensure the consistency of the research data.

In addition, member checking was conducted by reconfirming interview results with informants to ensure the researcher's interpretations aligned with the informants' experiences and perspectives. The study also utilized diligent observation and discussions with colleagues to increase the credibility and validity of the research results.

Results

Exposure Levels to Industrial Air Pollution

Table 1. Summary of Qualitative Themes and Supporting Evidence

Main Theme	Key Findings	Supporting Evidence	Interpretive Meaning
Exposure to Industrial Air Pollution	Residents reported continuous exposure to factory smoke, industrial dust, chemical odors, and emissions from heavy vehicles.	In-depth interviews and direct observations	Industrial activities and transportation constitute persistent environmental stressors for surrounding communities.

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Respiratory Health Conditions	Residents described recurring coughing, shortness of breath, throat irritation, prolonged colds, and other respiratory complaints.	Interviews and residents' health experiences	Respiratory problems have become part of the everyday experience of communities exposed to polluted air.
Community Perceptions and Experiences	Residents perceived that air quality had deteriorated, particularly during periods of increased industrial activity, at night, and during the dry season.	Interviews and observations	Air pollution affects perceptions of environmental quality, comfort, family health, and quality of life.
Community Adaptation Strategies	Residents reported closing windows and vents, cleaning houses more frequently, wearing masks, reducing outdoor activities, and modifying children's activities.	Interviews and observed practices	Adaptation is primarily conducted at the household level and provides only limited protection against persistent pollution.

The findings demonstrate an interconnected relationship between industrial air pollution, community health, perceptions, and adaptation practices. Continuous exposure to factory smoke, industrial dust, chemical odors, and heavy-vehicle emissions represents a persistent environmental stressor for surrounding communities, while recurring symptoms such as coughing, shortness of breath, throat irritation, and prolonged respiratory complaints indicate that polluted air has become an important part of residents' everyday health experiences. These environmental conditions also influence how communities perceive their living environment, particularly as residents associate worsening air quality with periods of increased industrial activity, nighttime conditions, and the dry season, contributing to discomfort, concerns about family health, and a reduced sense of environmental well-being. In response, residents adopt various household-level strategies, including closing windows and vents, cleaning their homes more frequently, wearing masks, limiting outdoor activities, and modifying children's daily activities. However, the findings suggest that these adaptive practices provide only limited protection because they address exposure at the individual or household level rather than reducing pollution at its source. Overall, the evidence indicates that industrial air pollution is not merely an environmental issue but a multidimensional problem that simultaneously affects respiratory health, daily experiences, quality of life, and community vulnerability.

The results indicate that urban communities around industrial areas in Dhaka experience high levels of exposure to air pollution in their daily lives. This exposure stems from industrial activities in the textile and manufacturing industries, the combustion of fossil fuels, and emissions from heavy vehicles operating near industrial areas. The environmental conditions studied revealed smoke billowing from factory chimneys, airborne dust clinging to surfaces in residents' homes, and a pungent odor experienced by residents, especially at night when production activity increases. Most residents stated

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that the air quality in their neighborhoods has declined significantly in recent years due to increased industrial activity and urban growth. Residents living near industrial areas reported being exposed to polluted air almost all day long, especially in the morning and evening when industrial smoke is denser. High residential density and a lack of green open spaces result in poor air circulation, allowing pollutants to linger longer in the neighborhood. Furthermore, most homes lack adequate ventilation, allowing dust and smoke to easily enter. These conditions expose residents not only to outdoor exposure but also to indoor exposure.

Residents living very close to industrial areas and major logistics transportation routes also experience greater air pollution. They describe the air in their surroundings as hot, dusty, and uncomfortable to breathe. Residents reported that at certain times, especially when factory activity increases, the air becomes darker and smells like chemicals or smoke from combustion. This situation indicates that industrial activity is a significant contributor to the decline in air quality in the urban research area.

One informant explained that the air quality in their neighborhood has worsened year after year due to increased industrial activity around the residential area. The informant said:

> *"Every morning there's black dust on the windows and floors. At night, the smoke from the factory is more noticeable and sometimes makes it difficult to breathe."*

This statement indicates that residents experience constant exposure to air pollution in their daily lives. Industrial dust and smoke not only pollute the outdoor environment but also enter household areas, increasing the risk of respiratory health problems.

Another informant explained that industrial activity is almost non-stop, making it difficult for residents to avoid exposure to polluted air. The informant stated:

> *"The air here is different from other areas. Sometimes it smells very strong, like burning plastic, especially at night when the factory is still operating."*

The interview results indicate that residents are aware of changes in air quality in their environment. They can recognize pollution patterns based on industrial operating hours and the changes in air conditions they experience daily.

In addition to industrial smoke, heavy vehicles transporting raw materials and products also contribute to worsening air quality in the study area. Industrial trucks generate road dust and vehicle exhaust, which increases exposure to air pollutants around residential areas. Congested and poor road conditions cause dust to become airborne, especially during the dry season. This further increases the level of exposure to air pollution for urban residents living near industrial areas.

One informant reported that residents often close doors and vents to reduce the entry of dust and smoke into their homes. The informant said:

> *"From afternoon to evening, we usually close all the windows because the smoke enters the house and the children start coughing."*

This statement indicates that residents have attempted various simple adaptations to reduce their exposure to air pollution. However, limited economic conditions and residential environments mean that these efforts have not been able to optimally protect residents from industrial air pollution.

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Overall, the study results indicate that levels of exposure to industrial air pollution in urban Dhaka are high and persistent. This condition is influenced by high industrial activity, dense residential areas, weak emission controls, and a lack of environmental infrastructure that supports healthy air quality for urban residents.

Community Respiratory Health Conditions

The study results indicate that the respiratory health of urban residents around industrial areas in Dhaka has significantly declined. Most informants reported frequently experiencing respiratory problems such as chronic coughing, shortness of breath, prolonged colds, throat irritation, and other respiratory disorders. These health complaints have been increasing in recent years, along with increased industrial activity and deteriorating air quality in residential areas. Communities living closest to industrial areas are the group most likely to experience respiratory health problems due to continuous exposure to industrial smoke and dust.

Respiratory problems are experienced not only by adults, but also by children and the elderly, who are considered more vulnerable to air pollution. Many parents report that their children are more prone to coughing, colds, and shortness of breath, especially at night or when industrial smoke is denser. Furthermore, some residents report feeling tired more quickly during activities due to difficulty breathing in polluted air. These conditions indicate that industrial air pollution has a direct impact on the daily health of urban residents.

Some residents stated that they had become accustomed to the poor air quality but still felt the physical impacts on their health. Several informants reported having to buy cough medicine more frequently and visit family health facilities due to recurring respiratory problems. This situation demonstrates that industrial air pollution not only impacts health but also increases the economic burden on urban households.

One informant explained that he had experienced a persistent cough since living in an industrial area. The informant said:

> *"I often cough, especially at night. Sometimes my chest feels tight when there is too much smoke from the factory."*

This statement demonstrates a link between air quality and the emergence of respiratory problems directly experienced by the community. Continuous exposure to polluted air causes people to experience respiratory discomfort during daily activities.

Another informant reported that children are the group most frequently affected by poor air quality. The informant said:

> *"My child has a cough and shortness of breath almost every month. When smoke comes out of the factory, he usually coughs continuously."*

The interview results showed that children have a higher level of sensitivity to industrial air pollution. Polluted environments make children's respiratory health more vulnerable than other age groups.

In addition to physical problems, residents also expressed concerns about the long-term health impacts of air pollution. Some informants feared developing chronic lung disease because they had lived in environments with poor air quality for years. However, some

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residents remained in the area due to economic constraints and the lack of healthier housing options.

One informant explained that respiratory problems had become part of daily life for residents living around industrial areas. The informant stated:

> *"Almost everyone here has experienced shortness of breath or a persistent cough. We're used to it, but it's very bothersome."*

This statement indicates that residents have begun to normalize respiratory health problems because of living in urban industrial areas. This phenomenon illustrates how air pollution has become part of the social reality of people living in environments with poor air quality.

The Relationship Between Air Pollution and Respiratory Disorders

Research results indicate a strong relationship between high exposure to industrial air pollution and increasing respiratory health disorders in urban communities in Dhaka. Residents living near industrial areas consistently experience various respiratory complaints such as chronic coughing, shortness of breath, throat irritation, persistent colds, and other respiratory disorders. These disorders tend to occur more frequently in communities living very close to industrial emission sources and in areas with poor air quality. This indicates that continuous exposure to air pollutants has a direct impact on the respiratory health of urban residents.

The link between air pollution and respiratory disorders is evident in the community's experience of linking respiratory symptoms to industrial activity in their neighborhood. Most informants stated that health problems worsen when industrial smoke increases, particularly at night and during the dry season. Airborne dust, chemical odors, and black smoke from factory chimneys are considered the main factors causing breathing difficulties and persistent coughing. Residents also reported that their health tends to improve when they are outside of industrial areas or when factory production activity decreases.

Long-term exposure to air pollution causes recurring respiratory disorders that are difficult to fully cure. Many informants reported having to regularly take cough medicine or take family members to health facilities due to persistent respiratory complaints. This situation indicates that industrial air pollution not only causes temporary health problems but also increases the risk of chronic respiratory disorders in urban communities.

One informant explained that shortness of breath and coughing often occur when industrial smoke is thicker than usual. The informant said:

> *"When there's a lot of smoke from the factory, breathing feels heavier and throats start to hurt. Children usually start coughing that night."*

These statements demonstrate that the community can recognize the relationship between changes in air quality and the emergence of respiratory disorders in daily life. Industrial activity is considered a major cause of the worsening public health conditions in the study area.

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Another informant reported that respiratory health problems have become more frequent since their residential area developed into a dense industrial area. The informant said:

> *"The air used to be different than it is now. After many factories were built, people started coughing and experiencing shortness of breath frequently."*

The interview results demonstrate a change in public health conditions with increasing industrialization in urban Dhaka. People directly experience the environmental impact on their health through an increase in the frequency of respiratory disorders.

Furthermore, the relationship between air pollution and respiratory disorders is also evident in vulnerable groups such as children and the elderly. Children are more prone to coughs, colds, and asthma when air quality worsens, while the elderly are more likely to experience shortness of breath and fatigue due to impaired respiratory function. This situation indicates that exposure to air pollution has an uneven impact and is more severe for groups with more vulnerable physical conditions.

One informant explained that his family experienced recurring health problems due to poor air quality in their neighborhood. An informant stated:

> *"We've become accustomed to living with dust and smoke, but almost every week, a family member develops a cough or has difficulty breathing."*

This statement demonstrates that respiratory problems have become a part of the lived experience for people in urban industrial areas. Daily exposure to air pollution causes ongoing health problems without adequate environmental protection.

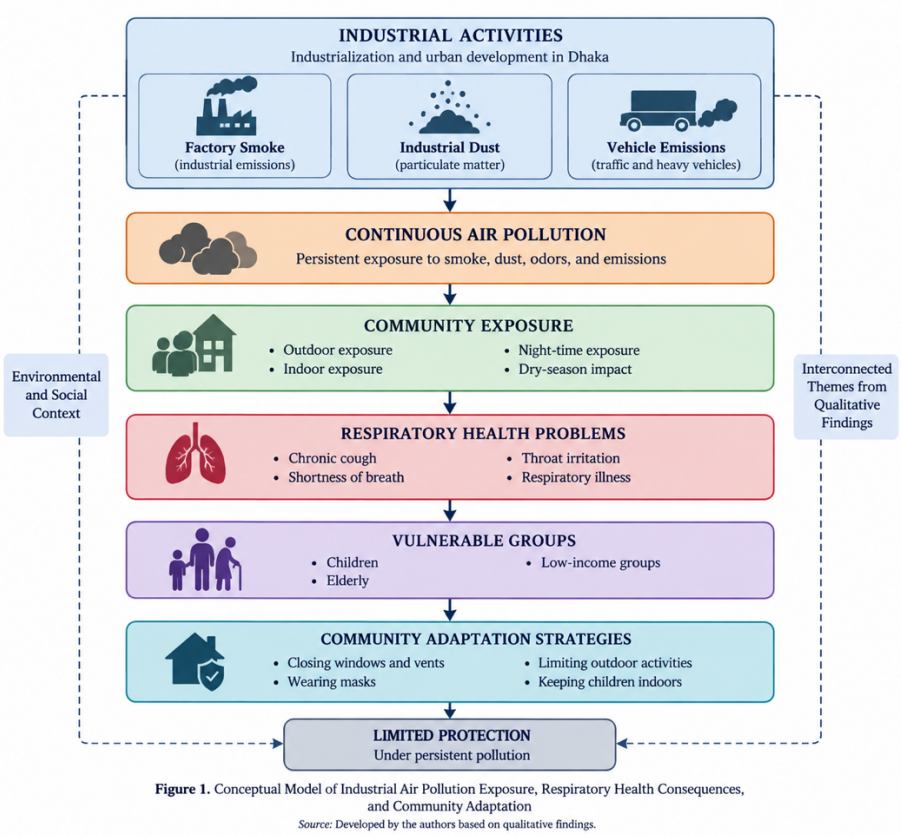


Figure 1. Conceptual Model of Industrial Air Pollution Exposure, Respiratory Health Consequences, and Community Adaptation

Source: Developed by the authors based on qualitative findings.

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Figure 1. presents a conceptual model illustrating how industrial activities in Dhaka, particularly factory smoke, industrial dust, and vehicle emissions, contribute to continuous air pollution and sustained community exposure. The figure indicates that prolonged exposure occurs across both outdoor and indoor environments, with night-time and dry-season conditions potentially intensifying community exposure. This persistent exposure is associated with respiratory health problems, including chronic cough, shortness of breath, throat irritation, and other respiratory illnesses, with children, elderly people, and low-income groups identified as particularly vulnerable. In response, communities adopt various adaptation strategies, such as closing windows and vents, wearing masks, limiting outdoor activities, and keeping children indoors; however, the model highlights that these measures provide only limited protection when pollution is persistent. Overall, the figure emphasizes the interconnected relationship between industrialization, environmental exposure, respiratory health consequences, social vulnerability, and community adaptation, providing a qualitative framework for understanding how industrial air pollution affects community health in an urban context.

Community Perceptions and Experiences of Air Pollution

Research results indicate that urban residents around Dhaka's industrial areas have a strong perception of the deteriorating air quality in their neighborhoods. Most residents recognize that air pollution has become a part of daily life and has a significant impact on their health, comfort, and social activities. Residents describe the air in their neighborhoods as hot, dusty, smoky, and sometimes accompanied by a pungent odor emanating from industrial activity. This perception stems from direct experience living in an environment with high levels of air pollution every day.

Most informants stated that significant changes in air quality have been felt since the increase in industrial activity and production in Dhaka's urban areas. Residents observed that the air has become dirtier than in previous years, and that conditions worsen at night when industrial activity is still ongoing. Furthermore, residents perceive air pollution to be more severe during the dry season because dust and smoke more easily spread into residential areas.

Residents view air pollution not only as an environmental problem but also as a threat to their families' health and quality of life. Many informants expressed concern about the long-term impacts of air pollution, particularly on children and the elderly, who are considered more vulnerable to respiratory health problems. However, some residents felt they had no choice but to remain in the area due to economic constraints and jobs dependent on industrial activity in the area.

One informant explained that the air quality in their neighborhood had become increasingly difficult to tolerate due to industrial activity occurring almost all day long. The informant stated:

> *"The air is much worse now than it used to be. Sometimes at night the smoke is so thick it's hard to breathe."*

This statement indicates that residents are experiencing tangible changes in air quality in their daily lives. The experience of living in an industrial area has made them highly aware of the impact of air pollution on their health.

Another informant stated that industrial dust and smoke have become part of the daily routine of residents in the study area. The informant said:

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"We clean our house every day because dust accumulates so quickly. If the windows are open, the smoke and odors come straight into the house."

The interview results show that air pollution is not only felt outside the home but also affects people's domestic spaces. These conditions make it difficult for people to maintain a clean and healthy environment, even within their own homes.

In addition to physical experiences, people also expressed a sense of helplessness regarding the ongoing air pollution. Some informants believe that the government and industry have not yet taken the health of the people living around industrial areas seriously. They feel their voices are rarely heard, and monitoring of industrial emissions remains very weak. This situation has given rise to frustration and distrust in the government's environmental protection efforts.

One informant explained that people frequently complain about the air quality but see no significant changes. The informant stated:

"We've often complained about factory smoke, but so far there's been no change. The air remains dirty every day."

This statement demonstrates the public's perception of the government's weak response to air pollution. These experiences reinforce the public's perception that they live in an environment that is inadequately protected.

On the other hand, some people have begun to view air pollution as normal because it has persisted for a long time. This normalization of air pollution occurs because people are accustomed to living in a polluted environment and lack alternative housing. This situation demonstrates how air pollution gradually shapes the social and cultural experiences of urban communities in industrial areas.

Community Adaptation Strategies

Research results show that urban communities around industrial areas in Dhaka have implemented various adaptation strategies to reduce the impact of air pollution on their health and daily lives. These strategies emerged as a community response to the continuing decline in environmental quality due to industrial activity. Although most of the efforts undertaken are simple and individual, people are trying to adapt their lifestyles to survive in an environment with high levels of air pollution.

One of the most common forms of adaptation undertaken by people is limiting the entry of smoke and dust into their homes. Many people choose to close doors and windows at certain times, especially when industrial activity increases in the afternoon and evening. Furthermore, people are cleaning their homes more frequently to reduce the accumulation of dust from industrial smoke and heavy vehicles around residential areas. This situation indicates that people are aware of the relationship between air quality and family health and are therefore striving to maintain a cleaner home environment.

Some people have also begun wearing masks when going outside, especially when air conditions appear to be worse than usual. However, mask use has not been consistently practiced due to economic constraints and low awareness among some people about the importance of respiratory health protection. Furthermore, residents reported that it was difficult to avoid exposure to polluted air because most of their work and social activities took place in the same industrial environment.

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One informant explained that his family tried to reduce smoke exposure by closing the house's vents when the air began to feel bad. The informant said:

> *"If the smoke starts to build up, we immediately close the windows and doors, so the dust doesn't enter the house."*

This statement indicates that residents are implementing household-based adaptations to minimize the impact of air pollution on their family members. However, these strategies only provide temporary protection because the overall environmental conditions remain polluted.

In addition to physical efforts, residents are also adapting through changes in daily behavior. Several informants stated that they reduce outdoor activities at night when industrial smoke is thicker. Children are also more often asked to stay indoors to reduce the risk of respiratory problems from exposure to polluted air. This strategy is especially used by families with small children or family members with a history of respiratory illness.

Another informant stated that residents are starting to adjust their activity times based on the air conditions in their environment. An informant said:

> *"Usually, we don't let the children play outside when the smoke from the factory is heavy."*

The interview results showed that the community has developed local knowledge about air pollution patterns based on their daily experiences. This knowledge is used to determine actions they believe can reduce health risks to their families.

In addition, some people utilize traditional medicine and consume herbal drinks to alleviate respiratory complaints caused by air pollution. The use of traditional concoctions such as ginger water, honey, and warm drinks is thought to help relieve coughs and throat irritation, which are frequently experienced by the community. However, some people recognize that these efforts cannot fully address the health impacts of persistent air pollution.

One informant explained that the community is trying to cope with various simple methods even though environmental conditions remain poor. The informant stated:

> *"We can only try to maintain our own health because the air here is already difficult to change."*

This statement demonstrates the community's awareness that their ability to control air pollution is very limited. Their adaptations are more about survival than comprehensive environmental solutions.

On the other hand, the research results also indicate that community adaptation strategies still face various obstacles. Economic constraints prevent some people from being able to purchase protective equipment or move to healthier environments. In addition, weak government support in controlling air pollution means that people must face the impacts of pollution independently without adequate environmental protection.

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Table 2. Triangulation Matrix of Qualitative Findings

Theme	Interview Evidence	Observation Evidence	Documentation Evidence
Air Pollution Exposure	Residents described smoke, dust, strong odors, and exposure patterns associated with industrial activities.	Smoke, dust, dense residential areas, limited ventilation, and nearby industrial and transportation activities were observed.	Air-quality reports and environmental documents were used as supporting materials.
Respiratory Health	Informants reported coughing, shortness of breath, throat irritation, and recurring respiratory complaints.	Environmental conditions provided contextual evidence of continuous exposure.	Public health information was used to support the interpretation of respiratory health experiences.
Community Perceptions and Experiences	Residents described worsening air quality, discomfort, concern for family health, and limited ability to change the situation.	Pollution was observed to affect residential and domestic environments.	Government and environmental policy documents provided institutional context.
Adaptation Strategies	Residents reported closing windows, wearing masks, limiting outdoor activities, and using household remedies.	Household and behavioral adaptations were observed as responses to polluted environmental conditions.	Environmental policies provided contextual information regarding pollution-control efforts.

The findings indicate that industrial air pollution is experienced by residents as a persistent environmental and social problem that affects both everyday living conditions and respiratory health. Residents' reports of smoke, dust, strong odors, coughing, breathing difficulties, throat irritation, and recurring respiratory complaints are supported by observations of dense residential areas, limited ventilation, and the proximity of industrial and transportation activities. These conditions also shape community perceptions, generating discomfort, concern for family health, and a sense of limited control over the surrounding environment. In response, residents employ practical adaptation strategies, such as closing windows, wearing masks, limiting outdoor activities, and using household remedies. However, these responses primarily reduce individual exposure rather than address the underlying pollution sources. Overall, the convergence of interview, observation, and documentary evidence suggests that

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industrial air pollution represents an interconnected environmental, health, and socioeconomic challenge requiring attention beyond individual household adaptation.

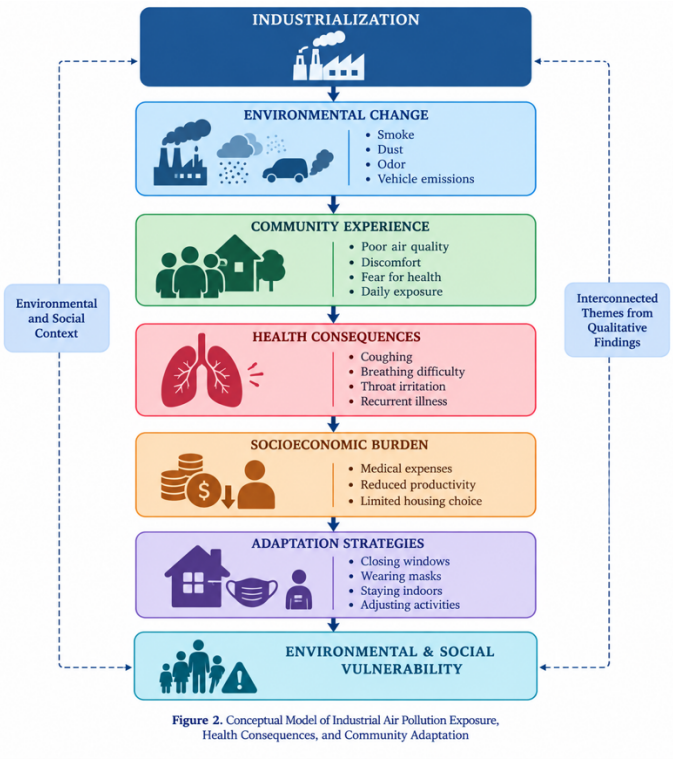


Figure 2. Conceptual Model of Industrial Air Pollution Exposure, Health Consequences, and Community Adaptation

Figure 2. interconnected pathway through which industrialization influences environmental conditions, community experiences, health outcomes, socioeconomic conditions, and adaptation responses. Industrial activities generate smoke, dust, odors, and vehicle emissions, which contribute to environmental changes and deteriorating air quality. These conditions shape the community's daily experiences through continuous exposure, discomfort, and concerns about health. Prolonged exposure is reflected in respiratory problems such as coughing, breathing difficulties, throat irritation, and recurrent illness. These health consequences may subsequently create socioeconomic burdens through increased medical expenses, reduced productivity, and constraints on housing choices. In response, community members adopt various coping strategies, including closing windows, wearing masks, staying indoors, and adjusting daily activities. However, these strategies provide only partial protection when exposure to pollution is persistent. Overall, the figure demonstrates that industrial air pollution is not solely an environmental issue but a multidimensional social and health concern in which environmental exposure, health consequences, socioeconomic burdens, and community adaptation interact to produce broader environmental and social vulnerability.

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Industrial Air Pollution, Environmental Inequality, and Urban Respiratory Health

This study aims to analyze the impact of industrial air pollution on the respiratory health of urban residents in Dhaka, focusing on the experiences of residents living in densely populated industrial areas. The results indicate that industrial air pollution is not only an ecological problem but also a form of urban public health crisis closely linked to social inequality, weak environmental governance, and the vulnerability of urban poor communities. The study findings demonstrate that residents living near industrial areas experience persistent exposure to air pollution, which significantly impacts the increase in respiratory health disorders such as chronic coughing, shortness of breath, asthma, and respiratory infections.

From an environmental health perspective, these research findings strengthen the argument that air quality is a major determinant of urban public health (Qin et al., 2023). Long-term exposure to industrial emissions such as particulate matter (PM2.5 and PM10), sulfur dioxide, and industrial combustion smoke causes inflammatory disorders of the respiratory tract that gradually reduce lung function. These findings align with various epidemiological studies showing that people living near industrial areas have a higher risk of developing chronic respiratory diseases due to long-term accumulated exposure to air pollutants (Marchetti et al., 2023). However, this study demonstrates that the impact of air pollution in Dhaka is not only related to biological aspects of health but is also influenced by the socio-economic conditions of urban communities, which increase their vulnerability to environmental pollution.

This study found that the urban poor are the group most affected by industrial air pollution. They live in areas with low environmental quality, high residential density, poor home ventilation, and limited access to healthcare. This situation demonstrates how air pollution operates within a framework of environmental inequality, where certain social groups bear a greater burden of environmental pollution than others (Ehigiamuseo et al., 2022). In the Dhaka context, industrialization and urbanization have created a pattern of spatial inequality where industrial areas develop alongside poor settlements without adequate environmental protection (Tan et al., 2024).

From the perspective of the Social Determinants of Health theory, this study demonstrates that community respiratory health cannot be understood solely as an individual medical issue, but rather because of urban social and economic structures (Bush et al., 2024). Factors such as poverty, dense housing, poor housing quality, and weak environmental regulations create conditions that increase community vulnerability to respiratory diseases. Thus, the respiratory health problems experienced by urban Dhaka residents are not only the result of biological exposure to air pollution but also a manifestation of social injustice and the failure of urban development that is not oriented towards environmental health (Rahaman et al., 2023).

The research findings also indicate that the community is highly aware of deteriorating air quality and its impact on their families' health. They can recognize the link between industrial activity and the emergence of respiratory disorders through everyday experience. However, this awareness is not accompanied by structural capabilities to significantly reduce health risks (Zawwadzki & Montibeller, 2023). Most community adaptation strategies remain individualistic, such as closing house vents, wearing masks, and limiting outdoor activities. This strategy demonstrates a form of adaptive survival

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mechanism, namely, a community's attempt to survive in a polluted environment without adequate institutional protection (Dibya et al., 2023).

This situation demonstrates that urban communities in industrial areas experience what environmental health studies call chronic environmental exposure, namely, continuous exposure to hazardous environments that is normalized in everyday life (Paseetto et al., 2024). This normalization of air pollution is evident in how people begin to perceive coughing, shortness of breath, and throat irritation as a normal part of industrial urban life. This phenomenon is theoretically important because it demonstrates that environmental pollution not only produces physical health impacts but also shapes a culture of social adaptation to environmental risks that persists (Alhamda, 2025).

This study also revealed weaknesses in environmental governance in controlling industrial air pollution. The public perceived that monitoring of industrial emissions was still weak and the government's response to public complaints was ineffective. This demonstrates a gap between industrialization-based economic growth and urban public health protection (Rahman et al., 2026). In the context of urban development in developing countries, industrialization is often positioned as an instrument of economic growth, while its ecological and public health costs tend to be overlooked (Hassan & Khalil, 2024). These findings demonstrate how an urban development model oriented toward industrial expansion without strong environmental controls can result in a long-term public health crisis.

The theoretical implication of this study is the need for an interdisciplinary approach to understanding the relationship between air pollution and urban public health. This research demonstrates that the impacts of air pollution cannot be explained solely through epidemiological or environmental health approaches but must be analyzed through an integration of social, political, economic, and urban studies perspectives. Thus, this research contributes to the development of public health studies that position public health because of the complex interaction between the physical environment and urban social structures.

The practical implications of this research are crucial for the formulation of environmental health policies in Dhaka and other industrial cities in developing countries. First, the government needs to strengthen industrial emission regulations and improve real-time air quality monitoring systems in densely populated urban areas. Second, integration of public health and urban planning policies is needed to prevent the development of industrial areas too close to residential areas. Third, the government needs to develop community-based respiratory health services for people living in areas with high levels of air pollution.

This research also emphasizes the importance of an environmental justice approach in urban development policies. The urban poor should not continue to bear the ecological burden of industrialization without adequate health and environmental protection. Therefore, air pollution control policies must be directed not only at the technical aspects of emission reduction, but also at protecting vulnerable groups and reducing environmental inequalities in urban areas.

Conclusion

This research shows that industrial air pollution in Dhaka has a significant impact on the respiratory health of urban residents, particularly those living near densely populated

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industrial areas. High exposure to smoke, dust, and industrial emissions leads to increased respiratory disorders such as chronic coughing, shortness of breath, asthma, and recurrent respiratory infections experienced by the community. These impacts are not only influenced by environmental factors but are also exacerbated by socioeconomic conditions such as poverty, overcrowding, limited access to healthcare, and weak environmental protection. This study also found that the community is aware of the deteriorating air quality and is attempting to implement various simple adaptation strategies, although their ability to reduce health risks remains very limited. In addition to demonstrating a close relationship between industrial air pollution and respiratory health, this study confirms that the problem of air pollution in urban Dhaka is a form of environmental health crisis and social injustice that requires strengthened environmental governance, industrial emission controls, and more inclusive public health policies oriented toward protecting vulnerable groups.

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