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Assessing the Health Impacts of Urban Air Pollution on Marginalized Populations in Bangladesh

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ABSTRACT

Air pollution has become a paramount environmental and public health concern worldwide, significantly affecting socio-economic conditions and health, especially in emerging nations. The study aims to investigate the impact of air pollution on the health of marginalized populations in urban Bangladesh, concentrating on identifying pollution sources, analyzing health effects, assessing socio-economic vulnerabilities, and evaluating the efficacy of regulatory frameworks. A systematic review methodology was employed, integrating data from pertinent research and official publications to deliver a thorough study of air pollution sources and health effects in these communities. The results indicate that sources of air pollution, including automobile emissions, industrial waste, and unregulated brick kilns, disproportionately impact vulnerable communities due to their closeness to high-pollution areas. The health consequences, particularly exacerbated respiratory and cardiovascular conditions, are more pronounced in these populations due to restricted healthcare access and socio-economic obstacles. Socio-economic vulnerabilities, including income level, housing circumstances, and access to healthcare, intensify exposure risks, underscoring differences in pollution exposure between marginalized and non-marginalized areas. The study suggests that although legal frameworks such as the Air Quality Management Project and the Brick Kiln Control Act establish a basis for air quality management, their inadequate enforcement in low-income regions diminishes their efficacy. This research underscores the necessity for focused policy interventions and community-oriented methods.

Keywords: Air pollution, Marginalized populations, Urban health disparities, and Environmental policy.

INTRODUCTION:

Air pollution is a critical environmental and public health challenge worldwide, exerting considerable detrimental consequences on human health and well-being. The World Health Organization (WHO) estimates that outdoor air pollution causes around 4.2 million premature deaths globally each year, disproportionately affecting vulnerable and marginalized people. (WHO, 2024). Air pollution, consisting of fine particulate matter (PM2.5), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and ground-level ozone (O_3), is a primary contributor to respiratory and cardiovascular disorders, especially in heavily populated urban regions. The effects are exacerbated in low-income and marginalized groups that frequently encounter elevated exposure levels and insufficient healthcare resources to address pollution-related health consequences (WHO, 2024).

The Indian subcontinent faces severe and escalating issues from air pollution, exacerbated by growing industrialization, urbanization, and motorization.

India, Pakistan, and Nepal consistently record among the highest PM2.5 concentrations globally, attributed to urban development, traffic emissions, construction dust, and industrial operations. (Greenstone M. *et al*., 2015). In urban parts of this region, underprivileged people experience heightened exposure to air pollution due to their proximity to pollution hotspots, including industrial zones and high-traffic areas, coupled with inadequate housing and limited access to healthcare facilities. (Chowdhury *et al*., 2007). Research indicates that these neighborhoods endure an inequitable prevalence of respiratory and cardiovascular disorders due to prolonged exposure to substandard air quality, highlighting a troubling environmental imbalance in urban health outcomes. (Maheshwar Dwivedy, 2013).

In Bangladesh, the circumstances are especially dire in prominent urban areas like Dhaka, Chittagong, and Khulna, where air pollution levels often surpass the permissible thresholds established by both the WHO and national regulations.(Faisal Ahmed *et al.*, 2024). Dhaka ranks as one of the most polluted cities worldwide, with high PM2.5 and PM10 concentrations mostly due to automobile emissions, brick kilns, construction, and industrial operations. (Begum & Hopke, 2018). The marginalized urban people in Bangladesh are particularly susceptible, frequently residing in densely populated regions with inadequate infrastructure and near pollution sources. This proximity intensifies their health risks, as seen by the elevated incidence of respiratory disorders, cardiovascular diseases, and other health conditions associated with pollution in these communities (Rahman & Alam, 2021). The health effects of air pollution on marginalized people are a significant worry due to the country's fast urbanization and continuous industry. In Bangladesh, more than 63% of the population lives in metropolitan areas, where industrial emissions, automobile exhaust, building activities, and biomass combustion significantly contribute to heightened pollution levels. (WHO, 2024).

Marginalized people, such as low-income communities, slum inhabitants, and informal sector laborers, are especially susceptible due to their restricted access to healthcare, financial limitations, and frequently inadequate living conditions (Begum and Hopke, 2018). Moreover, marginalized communities typically inhabit low-income, densely populated regions, where their closeness to industrial sites and main transport corridors markedly heightens their exposure to toxic chemicals. A major element contributing to the vulner-ability of marginalized communities in metropolitan Bangladesh is socioeconomic inequality, which influences living conditions, health status, and resilience to environmental hazards (Najmun Nahar *et al,*. 2022). Marginalized groups, particularly individuals in low-income brackets and ethnic minorities, frequently lack the resources to move to less polluted regions, so rendering them vulnerable to the detrimental environmental conditions in their vicinity. Further-more, inadequate policy execution and deficient urban planning intensify these problems. The Bangladeshi government has implemented measures to mitigate industrial emissions and vehicular pollution: however, enforcement is patchy, especi-ally in economically deprived regions (Hossain *et al.,* 2021; Peimani M., and Kalantari A., 2024).

The absence of research investigating the interplay between socio-economic determinants and insufficient healthcare access exacerbates health risks, creating a substantial void in comprehending the comprehensive scope of environmental injustice and public health issues affecting underprivileged urban residents in Bangladesh. The objective of this work is to provide a thorough examination of air pollution sources in metropolitan regions of Bangladesh, emphasizing the spatial distribution of these contaminants within underprivileged groups. This study aims to investigate the health effects of air pollution exposure on these populations, focusing specifically on respiratory, cardiovascular, and other pollution-related disorders. This research will examine socio-economic and demographic factors that increase vulnerability, focusing on the inequalities in air quality and exposure levels between marginalized and non-marginalized groups. The study seeks to assess the efficacy of environmental policies and regulatory frameworks in reducing pollution and safeguarding underprivileged urban people in Bangladesh. Addressing the impact of air pollution on vulnerable communities is crucial for ensuring fair health outcomes and enhancing the quality of life in urban Bangladesh. This review seeks to consolidate current research on air pollution and health inequalities, emphasizing the role of

socio-economic determinants in intensifying the health impacts of pollution exposure among under-privileged urban communities. This study analyzes the intersections of environmental pollution, socio-economic vulnerability, and health outcomes to inform targeted policy interventions and identify opportunities for future research in urban health and environmental management in Bangladesh. The research conducted by addressing some research questions based on objectives, like, a) What are the primary sources of air pollution in urban areas of Bangladesh, and how are they spatially distributed within marginalized communities? b) How does exposure to air pollution affect the health of marginalized populations in urban Bangladesh, particularly concerning respiratory, cardiovascular, and other pollution-related diseases? c) What socio-economic and demographic factors contribute to the increased vulnerability of marginalized groups to air pollution in urban Bangladeshi settings? d) What disparities exist in air quality and exposure levels between marginalized and non-marginalized communities in Bangladesh's urban areas? e) How effective are current environmental policies and regulatory frameworks in reducing air pollution exposure and protecting marginalized populations in urban Bangladesh?

METHODOLOGY:

This study used a qualitative research design that analyses secondary data to investigate the complex interplay between air pollution, health outcomes, and socio-economic issues impacting marginalized communities in metropolitan Bangladesh. This methodology entailed a comprehensive examination of academic databases, including PubMed, JSTOR, Google Scholar, and pertinent national research portals, concentrating on papers published during the past 10 to 15 years. Targeted search phrases, such as "air pollution and health," "marginalized communities," and "urban Bangladesh," were employed to locate peer-reviewed literature, governmental reports, and statistics that pertain to the principal concerns of air quality and health inequities in this setting.

The research utilized a descriptive and analytical approach, relying on existing academic literature, governmental papers, NGO publications, media articles, and historical documents as primary data sources. Data analysis has revealed repeating patterns and themes pertinent to the objectives. The content analysis was employed to evaluate current policies in Bangladesh concerning air pollution and public health, highlighting deficiencies in implementation that disproportionately impact under-privileged people. Content analysis facilitates a methodical examination of repeating patterns and topics within textual material (Krippendorff, 2018).

Inclusion criteria

Criteria for inclusion in the study. Incorporated according to defined criteria to guarantee the relevance and quality of the research. The geographical focus is on metropolitan areas of Bangladesh, which is crucial for comprehending the situation of marginalized communities inside the nation. The evaluation exclusively encompassed research that primarily focus on marginalized or low-income urban populations. Only peer-reviewed studies, official reports, and pertinent NGO publications will be evaluated, ensuring that the review accurately reflects current facts and trends. Furthermore, works utilizing quantitative, qualitative, or mixed-method approaches were deemed appropriate for inclusion.

Table 1: Research Design and Methodological Framework.

Aspect	Details
Research Design	Qualitative research design using secondary data to explore the interplay between air pollution, health outcomes, and socio-economic issues.
Data Sources	Academic databases: PubMed, JSTOR, Google Scholar, and national research portals; peer-reviewed literature, governmental reports, NGO publications, and media articles.
Timeframe of Literature Reviewed	Focus on papers published in the last 10 to 15 years.
Search Phrases	Targeted search phrases: "air pollution and health," "marginalized communities," and "urban Bangladesh."

Aspect	Details
Data Analysis Approach	Descriptive and analytical approach to identify repeating patterns and themes relevant to air quality and health inequities.
Content Analysis	Employed to evaluate current policies related to air pollution and public health, highlighting implementation deficiencies affecting marginalized communities.
Thematic Findings	Revealed patterns related to health inequities, socio-economic impacts, and air pollution effects on marginalized communities.
Framework for Analysis	Based on Krippendorff's (2018) content analysis methodology for systematic examination of textual materials.
Source: Author (2024)	

This table effectively summarizes the key elements of the research methodology, allowing readers to understand the approach and focus of the study at a glance.

Exclusion criteria

Exclusion criteria were implemented to eliminate irrelevant studies. Research conducted outside metropolitan regions of Bangladesh was eliminated to concentrate on the distinct issues encountered by marginalized communities in urban environments. Furthermore, research that fails to specifically investigate marginalized or low-income areas or those that concentrate on general populations without differentiating socio-economic status, will be eliminated. Publications over 15 years have been excluded to guarantee that the evaluation includes the most current evidence and advancements in the field. Ultimately, studies deficient in methodological rigor, including those missing clear definitions, sufficient sample numbers, or suitable statistical analyses, were removed from the review. The evaluation seeks to provide a targeted and pertinent analysis of the impact of air pollution exposure on the health of underprivileged communities in metropolitan Bangladesh by implementing these inclusion and exclusion criteria.

RESULTS:

This study aims to conduct a complete investigation of air pollution sources in metropolitan regions of Bangladesh, emphasizing the geographical distribution of these contaminants within underprivileged groups. This study aims to investigate the health effects of air pollution exposure on these populations, focusing specifically on respiratory, cardiovascular, and other pollution-related disorders. The research will examine socio-economic and demographic factors that increase vulnerability, focusing on inequalities in air quality and exposure levels between marginalized and non-marginalized groups. The study seeks to assess the efficacy of environmental policies and regulatory frameworks in reducing pollution and safeguarding underprivileged urban people in Bangladesh. The principal sources of air pollution in metropolitan regions of Bangladesh and their spatial distribution, especially concerning underprivileged communities. Certain studies have identified sources of contamination. Refer to **Table 1** for a description of the source and its particular effects on vulnerable populations. Industrial emissions from factories and manufacturing facilities are a significant source of air pollution, especially in urban areas.

Air pollution in Bangladesh's urban areas and its spatial distribution in marginalized communities

Table 2: Sources of Air Pollution in Urban Areas of Bangladesh and Their Spatial Distribution in Marginalized Communities.

Source of Pollution	Description	Impact on Marginalized Communities	Examples of Affected Areas
Industrial Emissions	Emissions from factories and manufacturing units	Increased exposure to harmful pollutants like PM and VOCs	Dhaka, Chittagong
Brick Kilns	Emission from traditional brick-making processes	Elevated levels of particulate matter, respiratory issues	Peri-urban areas around Dhaka

Source of Pollution	Description	Impact on Marginalized Communities	Examples of Affected Areas
Vehicular Emissions	Exhaust from automobiles and motorcycles	Higher concentrations of NOx and CO, contributing to poor air quality	Busy roads in urban slums
Domestic Sources	Burning of solid fuels for cooking and heating	Indoor air pollution leads to health issues	Low-income neighborhoods
Construction Activities	Dust and emissions from construction sites	Increased particulate matter exposure	Ongoing construction in urban areas
Source: Author (2024)			

As Dhaka and Chittagong, where disadvantaged groups frequently live near these industrial operations. Research demonstrates that these emissions markedly elevate exposure to detrimental pollutants, such as particulate matter (PM) and volatile organic compounds (VOCs), leading to increased health hazards. Brick kilns, typically located in peri-urban regions, represent a significant source of air pollution. These kilns emit significant quantities of particulate matter, associated with respiratory ailments and other health concerns affecting nearby underprivileged communities (Nargis *et al.*, 2022). Moreover, the dependence on conventional brick-making techniques, combined with inadequate regulatory supervision, intensifies this issue, resulting in heightened pollution levels in areas unable to evacuate. Vehicular emissions pose an additional difficulty, as urban slums are frequently situated along heavily trafficked roadways populated by older, more polluting vehicles. Studies indicate that these emissions result in elevated levels of nitrogen oxides (NOx) and carbon monoxide (CO), hence exacerbating air quality issues in these areas (Hasan *et al.*, 2022).

The influence of residential sources, especially the combustion of solid fuels for cooking and heating, is considerable, as it exacerbates indoor air pollution that disproportionately impacts low-income households. Construction activities in metropolitan regions produce dust and pollutants, exacerbating particulate matter exposure in communities already afflicted by pollution from other sources. The aggregate impact of these diverse pollution sources underscores the pressing necessity for specific measures to alleviate air pollution and safeguard the health of under-privileged communities in metropolitan Bangladesh. The chart highlights the intricate relationship between socioeconomic determinants and environ-mental health, emphasizing the need for effective policy interventions to mitigate these inequities. Investigating the sources of pollution between global and Bangladesh is not significantly different as shown in **Fig. 1**.

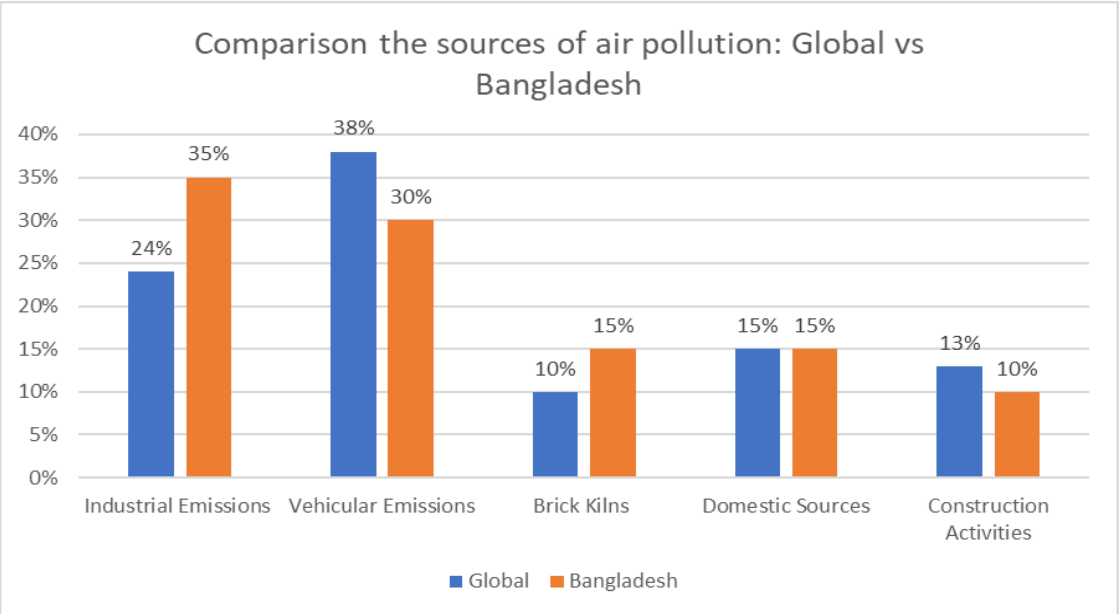

Fig. 1: Comparison Source of Pollution Between Global and Bangladesh (Source: Author, 2024).

The health impacts of air pollution exposure on marginalized populations

The health effects of air pollution on marginalized groups in metropolitan Bangladesh are significant, with exposure predominantly associated with respiratory, cardiovascular, and other pollution-related illnesses. Research demonstrates that marginalized communities experience increased exposure to pollutants such as PM2.5, Sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and carbon monoxide (CO), which substantially contribute to health problems due to their proximity to pollution sources, including industrial areas, major thoroughfares, and regions with high vehicular density. These communities often encounter heightened PM2.5 levels, leading to an increased incidence of respiratory disorders, including asthma and chronic obstructive pulmonary disease (COPD) (Khandker *et al.*, 2022). However, the principal health effects of air pollution on underprivileged communities in metropolitan Bangladesh, are categorized by specific diseases and associated contaminants. In the initial category, respiratory diseases, pollutants including PM2.5, Sulphur dioxide (SO_2), and nitrogen dioxide (NO_2) signify-cantly exacerbate illnesses such as asthma, chronic obstructive pulmonary disease (COPD), and various lung infections. Research demonstrates that children, the elderly, and low-income individuals residing in pollution-dense regions, such as those adjacent to factories or main thoroughfares, face a heightened risk of respiratory issues (Khuda, 2020).

Table 3: Health Impacts of Air Pollution on Marginalized Populations in Urban Bangladesh.

Health Impact Category	Key Pollutants Involved	Common Health Effects	Affected Populations
Respiratory Diseases	PM2.5, SO_2, NO_2	Asthma, COPD, lung infections, chronic cough	Children, elderly, low-income adults
Cardiovascular Diseases	NO_2, SO_2, CO	Hypertension, heart attacks, stroke	Adults, elderly
Other Pollution-Related Diseases	VOCs, heavy metals	Weakened immune function, adverse pregnancy outcomes	Children, pregnant women, elderly
Source: Author (2024)			

The second group, cardiovascular diseases, emphasizes pollutants such as NO_2, SO_2, and carbon monoxide (CO), which are associated with heightened occurrences of hypertension, myocardial infarctions, and cerebrovascular accidents. These pollutants elicit inflammatory reactions in the body, resulting in oxidative stress and harming the cardiovascular system. This is particularly apparent in adults and the elderly within marginalized communities who are more prone to living in regions with elevated vehicle and industrial pollutants (Nargis *et al.,* 2022). The third group, Other Pollution-Related Diseases, pertains to exposure to volatile organic compounds (VOCs) and heavy metals, which impair immune responses and heighten vulnerability to infections. However, vulnerable populations encompass children and pregnant women, who face heightened risks of negative pregnancy outcomes, including preterm birth and low birth weight, in places with elevated pollution levels. Moreover, the elderly encounter heightened risks owing to the synergistic impact of age-associated immunological deterioration and extended exposure to these poisons (Hossain *et al.,* 2021). This table (see **Table 2**) highlights the varied health risks faced by marginalized communities due to air pollution exposure, emphasizing the need for policy interventions to mitigate these impacts and improve environmental health equity in urban Bangladesh.

Socio-economic and demographic factors contributing to higher vulnerability to air pollution among marginalized groups in urban Bangladesh.

In metropolitan regions of Bangladesh, socio-economic and demographic factors considerably exacerbate the susceptibility of underprivileged populations to air pollution exposure. Studies demonstrate that these populations frequently reside in regions with elevated pollution levels, attributable to industrial operations, heavy traffic, and insufficient natural spaces (Clougherty, 2010). Socio-economic limitations, like inadequate income and restricted housing availability, compel numerous underprivileged groups to live near pollution

sources, hence heightening their suscep-tibility to pollution-related health problems. Socio-economic and demographic factors that exacerbate the susceptibility of marginalized urban people in Bangladesh to air pollution, along with the effects of each aspect. The Income Level element is crucial as low-income families sometimes reside in affordable yet highly polluted regions adjacent to industrial zones and major thoroughfares. These settings heighten exposure to contaminants, but constrained financial resources limit access to healthcare and the feasibility of relocation to cleaner environments (Islam, 2022). Educational attainment contributes to susceptibility, as those with lesser education frequently lack awareness of the health concerns linked to pollution and are employed in high-risk occupations within industries such as manufacturing and construction, where exposure levels are heightened. This deficiency in understanding preventive measures exacerbates their vulnerability (Khan *et al.*, 2023a). Educational attainment contributes to susceptibility, as those with lesser education frequently lack awareness of the health concerns linked to pollution and are employed in high-risk occupations within industries such as manufacturing and construction, where exposure levels are heightened. This deficiency in understanding preventive measures exacerbates their vulnerability (Namdeo *et al.*, 2011). The Household Size factor relates to the prevalence of larger families in low-income communities, who often live in overcrowded conditions with poor ventilation. Solid fuels are commonly used for cooking due to economic limitations, leading to increased indoor pollution, which further heightens health risks (Hossain *et al*., 2021). Finally, gender roles significantly influence exposure levels, since women in low-income homes frequently assume cooking responsibilities, hence increasing their exposure to elevated indoor air pollution from solid fuels. Cultural barriers may restrict women's access to healthcare, exacerbating their pollution-related health effects (Rahman & Alam, 2021). Following the **Table 3**.

Table 4: Socio-Economic and Demographic Factors Contributing to Higher Vulnerability to Air Pollution Among Marginalized Groups in Urban Bangladesh.

Factor	Description	Impact on Vulnerability	Affected Groups
Income Level	Low-income groups reside near pollution sources (e.g., factories, and roads) due to affordable housing options.	Increased exposure, limited relocation, and healthcare access	Low-income households
Educational Attainment	Lower education limits job options and awareness of pollution risks.	Higher exposure in high-risk occupations reduced knowledge of preventive measures.	Low-education individuals
Age	Children and the elderly are physiologically vulnerable to pollutants.	Increased susceptibility to respiratory and cardiovascular issues	Children, elderly
Household Size	Larger households, often in crowded spaces, use solid fuels due to cost constraints.	Higher indoor pollution, inadequate ventilation	Large, low-income families
Gender Roles	Women face increased exposure due to domestic roles and cooking with solid fuels.	Elevated respiratory health risks, limited healthcare access	Women in low-income households
Source: Author (2024)			

Disparities in air quality and exposure levels between marginalized and non-marginalized communities:

The differences in air quality and exposure levels between disadvantaged and non-marginalized populations in metropolitan Bangladesh highlight substantial discrepancies in environmental health risks. Research indicates that marginalized communities, frequently situated near industrial areas, major thoroughfares, and informal waste disposal sites,

experience significantly greater exposure to pollutants such as particulate matter (PM2.5), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and volatile organic compounds (VOCs) than affluent, non-marginalized neighborhoods (Shahrukh e*t al*., 2023). The discrepancies mostly arise from the spatial distribution of residential zones, as marginalized people generally reside in lower-cost housing situated in locations with elevated pollution levels. Studies show that the average concentration of PM2.5 in disadvantaged communities frequently surpasses the World Health Organization's (WHO) recommended thresholds, intensifying health hazards for inhabitants (Rahman & Alam, 2021). The discrepancies mostly arise from the spatial distribution of residential zones, as marginalized people generally reside in lower-cost housing situated in locations with elevated pollution levels. Studies show that the average concentration of PM2.5 in disadvantaged communities frequently surpasses the World Health Organization's (WHO) recommended thresholds, intensifying health hazards for inhabitants (Hossain *et al.*, 2021).

Data on NO_2 concentrations also underscore variations in air quality among different populations. In marginalized regions, NO_2 concentrations are typically elevated due to traffic pollution and insufficient green spaces that may otherwise mitigate pollutants. A study in Dhaka revealed that NO_2 concentrations in lower-income regions were twice as high as those in rich areas, highlighting the correlation between socioeconomic status and exposure to traffic-related pollution (Moore *et al.*, 1997). SO_2 exposure significantly differs among communities, with marginalized populations disproportionately affected by emissions from adjacent industrial operations. This pollutant, predominantly released by industrial facilities and power generation plants, poses a considerable danger for respiratory illnesses. Marginalized communities adjacent to pollution sources frequently exhibit SO_2 levels that exceed health-based guidelines established by national authorities, highlighting the disparity in exposure (Hossain ***et al***., 2021). Furthermore, inequalities in exposure to volatile organic compounds (VOCs), encompassing various chemicals emitted from industrial activities and waste, are significant among these groups. Inhabitants of marginalized communities frequently report exposure to these substances, resulting in increased risks of respiratory and other pollution-related health problems (Fahmida Khatun & Kashfia Ashraf, 2021). In contrast, non-marginalized communities, typically removed from industrial operations, encounter reduced levels of VOC exposure. The data indicate that marginalized groups in urban Bangladesh experience significantly higher levels of air pollution exposure than non-marginalized communities. The disparity is exacer-bated by socio - economic status, residential location, and restricted access to resources, highlighting the necessity for policy interventions to tackle environmental inequality and guarantee equitable access to cleaner air in all metropolitan populations in Bangladesh.

The Role of Environmental Policies and Regulatory Frameworks in Mitigating Air Pollution

To acquire knowledge the examination of environmental policies and regulatory frameworks in alleviating air pollution and safeguarding marginalized populations in urban Bangladesh concentrated on existing literature. Bangladesh has enacted environmental policies and regulatory frameworks aimed at reducing urban air pollution and its unequal effects on vulnerable communities. Principal strategies concentrate on diminishing emissions from industrial sectors and transportation, enhancing air quality surveillance, and establishing emission benchmarks. Nonetheless, the implement-tation of these policies frequently differs, leaving underprivileged communities susceptible due to insufficient local enforcement, poor resources, and various socio-economic obstacles. **Table 4** delineates key environmental policies and regulatory frameworks pertinent to air quality management in metropolitan regions of Bangladesh, as well as their efficacy in addressing underprivileged communities.

The table illustrates that The National Environment Policy, (1992) established the groundwork for environmental protection in Bangladesh, addressing general pollutants such as PM2.5, SO_2, and NO_2, while emphasizing sustainable development. Although it seeks to regulate air pollution in metropolitan regions, enforcement in vulnerable populations, particularly in informal settlements, is still inadequate. Research has shown enforcement difficulties stemming from insufficient resources and the necessity for tailored pollution control measures to safeguard communities from elevated exposure levels (Ahmed *et al*., 2022). The Air

Quality Management Project (AQMP), established in the early 2000s, especially targets particle matter (PM2.5 and PM10). While air quality has improved in certain urban areas due to enhanced monitoring and data collecting, underprivileged neighborhoods continue to endure comparatively high levels of exposure.

Table 5: Indicates Policies and Regulatory Framework.

Policy/Regulation	Targeted Pollutants	Coverage in Marginalized Areas	Enforcement Strength	Key Challenges
National Environment Policy (1992)	PM2.5, SO_2, NO_2, VOCs	Limited in low-income areas	Moderate	Enforcement gap in urban slums and industrial zones
Air Quality Management Project (AQMP)	PM2.5, PM10	Moderate	Strong in main cities, weaker elsewhere	Limited reach in informal settlements
Brick Kiln Control Act (2013)	PM2.5, CO, SO_2	Significant but limited to kilns	Stronger enforcement near large kilns	Lack of monitoring in small, informal kilns
Vehicle Emission Standards (2015)	NO_2, CO	Broad, urban-focused	Moderate	Low enforcement due to infrastructure gaps
Environmental Conservation Act (1995)	General pollutants	Moderate	Weak	Poor application in high-density marginalized zones
Source: Author (2024)				

The implementation of AQMP is robust in major urban centers such as Dhaka, while it is less effective in densely populated informal settlements, where pollutant concentrations frequently surpass permissible limits (Land, 2021).

The Brick Kiln Control Act, (2013) regulates emissions from brick kilns, a highly polluting sector in Bangladesh. Brick kilns substantially contribute to PM2.5 and CO emissions, adversely affecting air quality in adjacent underprivileged populations. Although enforcement has intensified around bigger, registered kilns, unregistered and smaller kilns in informal sectors circumvent the regulation, resulting in ongoing exposure hazards for lower-income communities adjacent to these kilns (Hossain *et al.,* 2021) (Yamamoto *et al.,* 2014).

Finally, the Environmental Conservation Act, (1995) serves as an overarching regulatory framework to limit pollutant emissions across industries, but its enforcement in marginalized areas is notably weak. While the act provides a legal basis for environmental protection, marginalized communities frequently lack adequate monitoring and enforcement, exposing them to unregulated pollution sources like informal industrial sites and waste-burning practices (Salamat Khandker, n.d.). Overall, while Bangladesh has a suite of environmental policies and frameworks designed to mitigate urban air pollution, their effectiveness in marginalized communities remains limited due to uneven enforcement, and infrastructure gaps. However, the Vehicle Emission Standards (2015) seek to mitigate vehicular emissions by imposing restrictions on pollutants such as NO_2 and CO, especially in densely populated urban regions with elevated traffic levels. Notwithstanding these rules, underprivileged areas frequently endure heightened levels of traffic-related pollution due to their proximity to busy thoroughfares. The exposure is exacerbated by inadequate enforcement infra-structure, which undermines the efficacy of emis-sion restrictions in densely populated, low-income metropolitan areas, and socio-economic constraints. These findings underscore the need for targeted policy adjustments and enhanced enforce-ment mechanisms that specifically address the vulner-abilities of marginalized populations.

DISCUSSION:

The discourse on air pollution exposure in metro-politan Bangladesh illustrates a multifaceted interplay of socio-economic, demographic, and environmental elements, coupled with regulatory obstacles that disproportionately affect vulnerable populations. In Bangladesh, air pollution primarily originates from industrial activities, vehicular emissions, brick kilns, and inadequate waste management. These pollutants adversely impact respiratory and cardiovascular health, particularly

among marginalized populations who are more exposed to pollution sources and lack protective resources (Clougherty, 2010). The discourse on air pollution exposure in metropolitan Bangladesh illustrates a multifaceted interplay of socio-economic, demographic, and environmental elements, coupled with regulatory obstacles that disproportionately affect vulnerable populations.

Table 6: The key points of air pollution exposure in metropolitan Bangladesh.

Aspect	Details
Primary Sources of Air Pollution	Industrial activities Vehicularemission Brickkilns Inadequate waste management
Health Impacts	Adverse effects on respiratory and cardiovascular health Marginalized populations face higher risks due to increased exposure and lack of protective resources
Pollutant Concentrations	Higher levels of PM2.5, NO_2, SO_2, and VOCs in marginalized areas PM2.5 poses significant health risks in densely populated slums
Regulatory Frameworks	The Air Quality Management Project (AQMP) aims to reduce exposure Limited effectiveness due to inadequate representation of underprivileged groups
Challenges in Policy Implementation	Inadequate enforcement and monitoring in informal settlements hinder AQMP effectiveness Need for infrastructural improvements and community initiatives
Socio-Economic Vulnerabilities	Poor income and restricted access to healthcare elevate exposure and health risks Proximity to pollution sources exacerbates health concerns
Environmental Legislation	Environmental Conservation Act (1995) fails to address specific vulnerabilities of low-income groups The Brick Kiln Control Act (2013) regulates larger kilns but informal ones remain unregulated
Informal Sector Dynamics	Unregulated brick kilns are significant pollution sources Informal sectors often evade regulation, necessitating comprehensive strategies
Need for a Holistic Approach	Environmental regulation alone is insufficient Targeted community interventions and socio-economic support are essential to address root causes of exposure
Inclusivity and Resilience in Policy	Regulatory frameworks must focus on inclusivity and resilience Adaptable enforcement to meet the unique challenges of marginalized communities is crucial
Long-term Public Health Outcomes	Emphasizing environmental justice enhances overall public health Addressing socio-economic disparities improves health outcomes for marginalized populations
Source: Author (2024)	

This table effectively summarizes the main findings and insights from the discussion, highlighting the complexity of air pollution issues and the need for comprehensive solutions in Bangladesh. In Bangladesh, air pollution primarily originates from industrial activities, vehicular emissions, brick kilns, and inadequate waste management. These pollutants adversely impact respiratory and cardiovascular health, particularly among marginalized populations who are more exposed to pollution sources and lack protective resources (Hassan *et al.*, 2022). The results indicate substantial differences in air quality between marginalized and non-marginalized groups, demonstrated by higher concentrations of pollutants such as PM2.5, NO_2, SO_2, and VOCs in marginalized regions. Research indicates that PM2.5 and other tiny particulate matter, recognized for their ability to infiltrate the lungs, provide a significant health risk in densely populated slums and low-income regions. Regulatory programs like the Air Quality Management Project (AQMP) have sought to reduce exposure, although their effectiveness is limited, as underprivileged groups continue to be inadequately represented by these efforts.

A study contends that inadequate policy enforcement and insufficient monitoring in informal settlements hinder the effectiveness of AQMP,

indicating that the air quality enhancements achieved by these programs are inequitably distributed along socio-economic lines. However, contrary to assertions that merely enhancing regulatory stringency will rectify this discrepancy, data indicates the need for infrastructural enhancements and community-level initiatives that particularly address the needs of marginalized neighborhoods (Hossain ***et*** *al*., 2021). The research emphasizes the socio-economic and demographic aspects that increase susceptibility to air pollution in underprivileged populations. Factors including poor income, restricted access to healthcare, and closeness to pollution sources correlate with elevated exposure levels and related health concerns. Exposure to pollutants such as NO_2 and SO_2 correlates with heightened incidences of respiratory diseases, including asthma and other chronic ailments, which disproportionately impact individuals with restricted access to preventive healthcare (Hossain *et al.*, 2021).

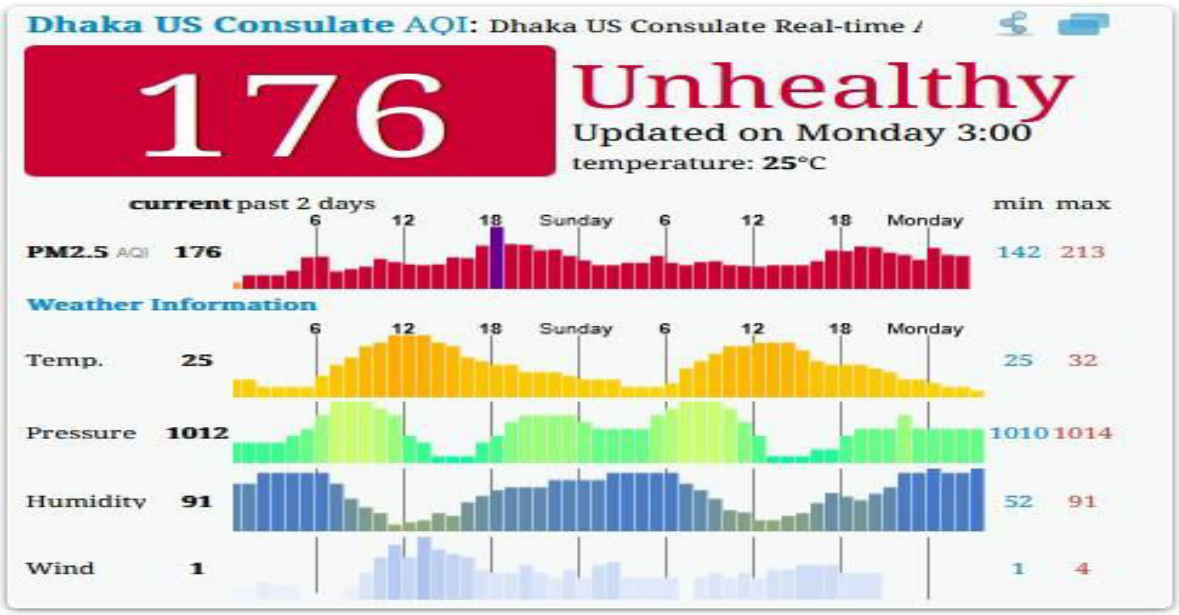

Fig. 2: Dhaka US Consulate Air Pollution: Real-time Air Quality Index (AQI) (41). (Estimated on Monday, Nov 4th, 2024, 03:00 am).

The Environmental Conservation Act, (1995) aims to restrict emissions in urban and rural regions: yet, it neglects the specific vulnerabilities of low-income groups, which endure heightened hazards due to substandard housing and insufficient green spaces (Ahmed *et al.,* 2022). In the absence of tailored interventions that recognize these socio-economic vulnerabilities, existing policies are likely to be inadequate in enhancing air quality in marginalized areas. Furthermore, a significant disparity exists between legislative frameworks and the actual conditions in marginalized areas. The Brick Kiln Control Act, (2013) has enhanced regulation of bigger, registered brick kilns: nonetheless, smaller, informal kilns, frequently situated near low-income areas, function without compliance inspections, resulting in localized pollution hotspots. Begum and Ali, (2021) observe that unregulated kilns are a major source of pollutants, compromising the Act's objective of decreasing overall air pollution levels. Although some contend that broadening the Act's scope will amplify its effectiveness, Hossain & Rahman, (2020) indicate that informal and unregistered sectors frequently circumvent regulation due to economic and logistical limitations, implying that a comprehensive strategy may be required. Consequently, policies must be both enforced and adaptable to tackle the distinct issues presented by informal economies, which disproportionately impact underprivileged people.

The discourse thus underscores a multifaceted dilemma. Environmental policies in Bangladesh establish a foundation for mitigating pollution sources and safeguarding public health. However, the execution of these rules frequently fails to encompass underprivileged populations, which are disproportionately affected by air pollutants due to socio-economic and spatial disparities. The literature agrees that environmental regulation alone cannot

rectify these disparities: instead, a holistic approach incorporating targeted community interventions, enhanced monitoring, and socioeconomic support is essential to tackle the fundamental causes of exposure and vulnerability (Khan *et al*., 2023b).

To effectively safeguard marginalized people, Bangladesh's regulatory frameworks must emphasize inclusivity and resilience, ensuring that enforcement is adaptable and sensitive to the distinct obstacles encountered by these communities. This strategy would not only advance environmental justice but also enhance long-term public health outcomes across socio-economic disparities.

Table 7: Recommendations for future environmental policy in Bangladesh to address urban air pollution and protect vulnerable populations.

Recommendation	Objective	Key Actions
Strengthening Air Quality Monitoring in Vulnerable Areas	Reduce pollution exposure disparities by identifying hotspots	Expand air quality monitoring networks in low-income areas to track pollution levels and inform targeted policies
Establishing Emission Caps for Industrial Zones Near Residential Areas	Protect residents near industrial zones from pollutant exposure	Enforce stricter emission standards for industries close to populated areas, focusing on PM2.5, SO_2, and NO_2 pollutants
Promoting Affordable, Clean Energy Alternatives in Low-Income Households	Improve indoor air quality and reduce health disparities	Provide subsidies for clean energy (e.g., LPG, electricity) to replace solid fuels, particularly benefiting women and children
Increasing Green Spaces in High-Pollution Urban Areas	Reduce airborne pollutants and enhance well-being	Develop green spaces in densely populated, polluted neighborhoods to absorb pollutants and create natural buffers
Developing Targeted Health Programs for Pollution-Related Illnesses	Address health inequities from pollution exposure	Create healthcare programs focusing on respiratory, cardiovascular, and immune-compromised conditions in marginalized areas
Implementing Traffic Control Measures in High-Density Areas	Decrease pollution from traffic, particularly NO_2 and PM2.5	Introduce vehicle restrictions, enhance public transport, and enforce stricter emissions standards in densely populated areas
Incorporating Air Quality Awareness in Education Programs	Empower communities with knowledge of pollution prevention	Integrate air quality education in school curricula and community programs to encourage pollution-reducing behaviors
Enforcing Zoning Regulations to Separate Residential and Industrial Areas	Minimize pollution exposure for residents near industrial zones	Implement zoning laws to create buffer zones between residential and industrial areas, improving air quality for residents
Strengthening the Enforcement of Environmental Laws and Penalties	Ensure consistent regulation compliance to reduce pollution	Increase penalties for violations and improve enforcement in under-regulated, marginalized areas
Integrating Health Impact Assessments in Policy Design	Prevent health disparities in new projects affecting disadvantaged neighborhoods	Mandate health impact assessments for projects near vulnerable communities to proactively manage pollution risks
Supporting Community-Led Pollution Reduction Initiatives	Foster community involvement in pollution management	Fund local initiatives to engage residents in identifying pollution sources and implementing localized solutions
Expanding Access to Healthcare for Pollution-Affected Populations	Improve health resilience against pollution-related diseases	Enhance healthcare access for low-income groups, focusing on treatment and prevention of pollution-related illnesses
Source: Author (2024)		

Recommendations for the Formulation of Future Environmental Policy

As urbanization accelerates in Bangladesh, metropolitan regions face escalating air pollution levels, disproportionately affecting underprivileged communities. These populations, often situated near pollution sources, experience heightened health risks, including respiratory and cardiovascular diseases. Addressing this environmental inequality requires targeted policies that prioritize vulnerable groups and ensure equitable access to clean air. The following recommendations focus on strengthening regulatory frameworks, enhancing pollution control measures, and promoting sustainable urban planning to safeguard public health and foster environmental justice in Bangladesh's urban centers.

Strengthening Air Quality Monitoring in Vulnerable Areas

To address uneven pollution exposure, expanding air quality monitoring networks in low-income urban areas is crucial. Enhanced monitoring will help identify pollution hotspots and measure air quality trends across different regions. This data can inform targeted policies that focus on high-risk zones, ultimately protecting marginalized communities from severe pollution impacts. This table outlines key actions for each recommendation, aiming to create equitable and sustainable environmental policies that address air quality challenges in urban Bangladesh.

Establishing Emission Caps for Industrial Zones near Residential Areas

Enforcing stricter emission caps for industries close to densely populated areas would help minimize pollution exposure among nearby residents. Factories emitting pollutants like PM2.5, SO_2, and NO_2 could be regulated through industry-specific standards that protect public health. Prioritizing emission control in industries adjacent to vulnerable communities can reduce health risks associated with respiratory and cardiovascular diseases.

Promoting Affordable, Clean Energy Alternatives in Low-Income Households

Since many low-income families rely on solid fuels, which increase indoor pollution, policies that subsidize clean energy alternatives like LPG or electricity are needed. Affordable access to cleaner fuels could significantly improve indoor air quality and reduce respiratory health issues, particularly for women and children who are often more exposed to indoor pollutants. Such measures can reduce health disparities linked to air quality within urban Bangladesh.

Increasing Green Spaces in High-Pollution Urban Areas

Establishing more green spaces in densely populated, high-pollution neighborhoods can help absorb pollutants and improve air quality. Green spaces act as natural buffers, reducing exposure to airborne contaminants and enhancing residents' well-being. Policies focused on urban greening can alleviate pollution-related health risks, particularly for communities living near industrial zones or major roads.

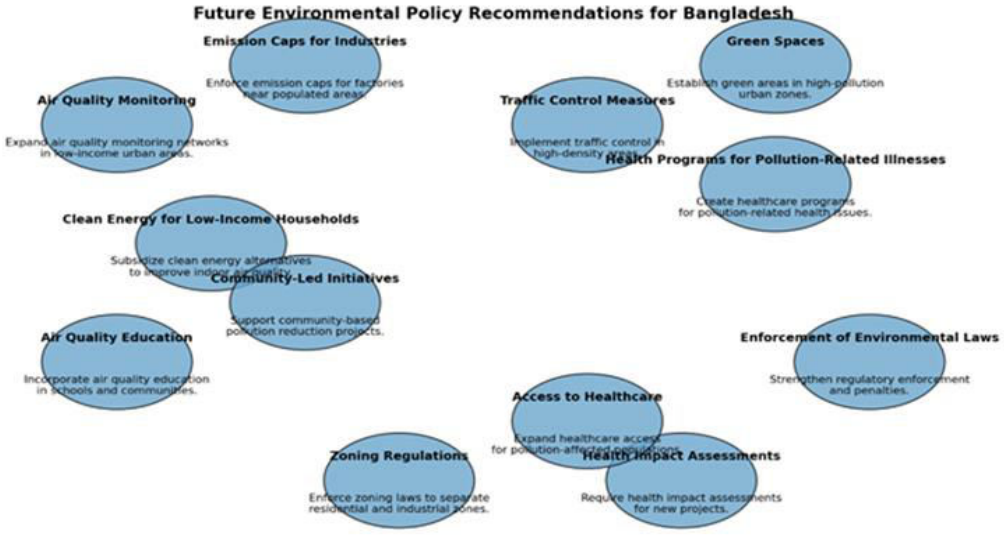

Fig. 3: This visual representation summarizes key policy suggestions for addressing air pollution and its effects on marginalized communities in Bangladesh.

Developing Targeted Health Programs for Pollution-Related Illnesses

Creating healthcare programs specifically for pollution-related illnesses in marginalized communities could address the health inequities arising from air pollution exposure. Such programs should prioritize respiratory, cardiovascular, and immune-compromised populations, offering preven-tive care and treatment. These initiatives can mitigate the disproportionate health impacts on vulnerable groups exposed to high pollution levels.

Implementing Traffic Control Measures in High-Density Areas

Traffic is a primary source of pollutants like NO_2 and PM2.5 in urban areas: therefore, policies reducing traffic congestion can lower pollution levels. Measures could include restricted vehicle zones, improved public transportation, and stricter emissions standards for vehicles. Targeting high-density areas near marginalized communities can reduce residents' exposure to harmful traffic-related pollutants.

Incorporating Air Quality Awareness in Education Programs

Educational programs on air pollution's health impacts can empower communities to adopt preventive measures. By incorporating air quality awareness in local school curricula and community workshops, residents can better understand and reduce their exposure to pollutants. Knowledgeable communities are better equipped to demand cleaner environments and make healthier choices.

Enforcing Zoning Regulations to Separate Residential and Industrial Areas

Establishing stricter zoning regulations to separate residential zones from industrial operations can reduce pollution exposure for communities. By creating buffer zones, the proximity of housing to polluting industries is minimized, leading to improved air quality in residential areas. Enforcing such regulations ensures that vulnerable populations are less impacted by nearby industrial emissions.

Strengthening the Enforcement of Environmental Laws and Penalties

Effective policy implementation requires stronger enforcement mechanisms, particularly in marginalized regions where regulations are often inadequately applied. Increasing penalties for pollution violations and ensuring consistent regula-tory enforcement can help mitigate pollution sources. Policies targeting strict enforcement can ensure industries comply with air quality standards, thereby protecting urban communities.

Integrating Health Impact Assessments in Policy Design

Policies addressing pollution should require health impact assessments, especially for projects near disadvantaged neighborhoods. By assessing potential health risks before project approval, policymakers can mitigate pollution exposure and health disparities. Such assessments will ensure that urban development projects do not disproportionately harm marginalized groups.

Supporting Community-Led Pollution Reduction Initiatives

Empowering communities to take active roles in air quality management can create a bottom-up approach to pollution control. Local initiatives, supported through government funding, can engage residents in identifying pollution sources and implementing solutions. Communitiled efforts can improve neighborhood-specific air quality issues, fostering a shared responsibility for environmental health.

Expanding Access to Healthcare for Pollution-Affected Populations

Marginalized groups often face limited access to healthcare, which compounds the health risks associated with pollution. Expanding healthcare access, with a focus on pollution-related illnesses, can help address this gap. Policies that enhance healthcare access for low-income populations can improve health outcomes and support long-term resilience against pollution-related diseases.

CONCLUSION:

This study highlights the significant and disproportionate effects of urban air pollution on underprivileged groups in Bangladesh, where socioeconomic and spatial inequalities intensify exposure risks and health consequences. Health repercussions, particularly respiratory and cardiovascular ailments, are significantly elevated in these communities due to restricted healthcare access and proximity to pollution sources, further highlighting the susceptibility of underprivileged groups to urban pollution. The report emphasizes that existing environmental

policies, despite their extensive coverage, inadequately address these inequities. Regulatory frameworks such as the Air Quality Management Project and the Brick Kiln Control Act are poorly enforced in informal settlements, where monitoring infrastructure and localized actions are limited. Socioeconomic variables, such as low income, inadequate housing, and restricted access to green spaces, exacerbate pollution exposure risks for marginalized populations, necessitating policy modifications for more equitable air quality management. This study offers significant insights into the effects of air pollution on underprivileged communities in metropolitan Bangladesh: yet, some limitations must be recognized. This research, as a systematic review, predominantly depends on secondary data sources, which may constrain the thoroughness of the investigation. The accessibility and quality of data about air pollution levels and health effects in marginalized communities are frequently uneven, especially in informal settle-ments where monitoring is scarce. This study examines regulatory frameworks and policies but does not quantitatively evaluate their enforcement levels or the direct effects of policy implementation on air quality enhancements. This study highlights socio-economic and spatial inequities but neglects to investigate additional intersecting factors, such as age, gender, and occupational exposure, that may influence varying health outcomes in marginalized populations. Given the anticipated rise in air pollution due to further urbanization, future research should investigate the long-term health effects of chronic exposure and the feasibility of adaptation strategies within Bangladesh's urban planning and environmental legislation.

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REFERENCES:

1) Ahmed, M., Shuai, C., & Khoso, W. M. (2022). Investigating health impacts of household air pollution on woman's pregnancy and sterilization: Empirical evidence from Pakistan, India, and Bangladesh. *Energy*, **247**.
2) Begum, B. A., & Hopke, P. K. (2018). Ambient Air Quality in Dhaka Bangladesh over Two Decades: Impacts of Policy on Air Quality. *Aerosol and Air Quality Research*, **18**(7), 1910-1920. https://doi.org/10.4209/aaqr.2017.11.0465
3) Chowdhury, Z., Zheng, M., & Russell, A. G. (2007). Speciation of ambient fine organic carbon particles and source apportionment of $PM_{2.5}$ in Indian cities. *J. of Geophysical Research: Atmospheres*, **112**(D15).
4) Clougherty, J. E. (2010). A Growing Role for Gender Analysis in Air Pollution Epidemiology. *Environmental Health Perspectives*, **118**(2), 167–176. https://doi.org/10.1289/ehp.0900994
5) Fahmida Khatun, S. Y. S., & Kashfia Ashraf. (2021). Breathing Uneasy: An Assessment of Air Pollution in Bangladesh.
6) Faisal Ahmed, Abu Zaher Mohammad Bayazid, & Md. Fahim Al Muntasir. (2024). The terrible air pollution in Dhaka city is getting worse. *GSC Advanced Research and Reviews*, **19**(1), 042–052. https://doi.org/10.30574/gscarr.2024.19.1.0133
7) Greenstone, M., N., J., Pande, & Sudarshan, A, S. (2015). Lower Pollution, Longer Lives: Life Expectancy Gains if India Reduced Particulate Matter Pollution. Economic and Political Weekly.
8) Hasan, M. J., Hassan, Md. & Amin, M. R. (2022). Acute Poisoning in Bangladesh: A Systematic Narrative Review. *Asia Pacific Journal of Public Health*, **34**(8), 812–816. https://doi.org/10.1177/10105395221127523
9) Hassan, S., Islam, T., & Bhuiyan, M. A. H. (2022). Effects of Economic and Environmental Factors on Particulate Matter (PM2.5) in the Middle Parts of Bangladesh. *Water, Air, & Soil Pollution*, **233**(8), 328. https://doi.org/10.1007/s11270-022-05819-y
10) Hossain, I., Rahman, M. S., & Khan, M. H. (2021). Environmental Overview of Air Quality Index (AQI) in Bangladesh: Characteristics and Challenges in Present Era. *Inter J. of Research in Engineering, Science and Management*, **4**(7), Article 7.
11) Islam, S. (2022). Geographic and socio-economic variations in markers of house-

hold air pollution in India: Prevalence, deter-minants, and co-exposure. *Air Quality, Atmosphere & Health*, **15**(10), 1881-1897. https://doi.org/10.1007/s11869-022-01223-x

12) Khan, S., Rathore, D., & Malaviya, P. (2023a). Socio-economic and environmental vulner-ability of urban slums: A case study of slums at Jammu (India). *Env. Science and Pollution Research*, **31**(12), 18074–18099. https://doi.org/10.1007/s11356-023-30630-5
13) Khan, S., Rathore, D., & Malaviya, P. (2023b). Socio-economic and environmental vulner-ability of urban slums: A case study of slums at Jammu (India). *Environmental Science and Pollution Research*, **31**(12), 18074-18099. https://doi.org/10.1007/s11356-023-30630-5
14) Khandker, S., Mohiuddin, A. S. M., & Abelsohn, A. (2022). Air pollution in Bangla-desh and its consequences. *Environmental Science and Pollution Research*.
15) Khuda, K. E. (2020). Air pollution in the capital city of Bangladesh: Its causes and impacts on human health. *Pollution*, **6**(4), 737-750.
16) Krippendorff, K. (2018). Content analysis: An introduction to its methodology. *Sage publications*.
17) Land, M. (2021). Mapping, Monitoring, and Modeling Land and Water Resources.
18) Maheshwar Dwivedy, R. K. M. (2013). The willingness of residents to participate in e-waste recycling in India-ScienceDirect. https://www.sciencedirect.com/science/article/abs/pii/S2211464513000262
19) Moore, M. V., Pace, M. L., & Driscoll, C. T. (1997). Potential Effects of Climate Change on Freshwater Ecosystems of The New England / Mid-Atlantic Reion, *Hydrological Processes*, **11**(8), 925-947.
20) Najmun Nahar, Z. H., & Sanjia Mahiuddin. (2022). Assessment of the environmental perceptions, attitudes, and awareness of city dwellers regarding sustainable urban environmental management: A case study of Dhaka, Bangladesh|Environment, *Development and Sustainability*. https://link.springer.com/article/10.1007/s10668-022-02354-y
21) Namdeo, A., Tiwary, A., & Farrow, E. (2011). Estimation of age-related vulnerability to air pollution: Assessment of respiratory health at local scale. *Environment International*, **37**(5), 829-837.
22) Nargis, A., Habib, A., & Cai, M. (2022). Source identification, contamination status, and health risk assessment of heavy metals from road clouds of dust in Dhaka, Bangladesh. *J. of Environmental Sciences*, **121**, 159-174.
23) Peimani M., and Kalantari A. (2024). Urban themes constructed in the Persian twitter, *Asian J. Soc. Sci. Leg. Stud.*, **6**(1), 1-18. https://doi.org/10.34104/ajssls.024.01018
24) Rahman, M. M., & Alam, K. (2021). The nexus between health status and health expenditure, energy consumption and environmental pollution: Empirical evidence from SAARC-BIMSTEC regions. *BMC Public Health*, **21**(1), 1694. https://doi.org/10.1186/s12889-021-11534-w
25) Salamat Khandker. (n.d.). (PDF) Air Pollution in Bangladesh and Its Consequences. https://www.researchgate.net/publication/358665434_Air_Pollution_in_Bangladesh
26) Shahrukh, S., Hossain, S. A., & Hossain, M. E. (2023). Air pollution tolerance, anticipated performance, and metal accumulation indices of four evergreen tree species in Dhaka, Bangladesh. *Current Plant Biology*, **35**.
27) WHO, (2024). Ambient (outdoor) air pollution.
28) Yamamoto, S. S., Phalkey, R., & Malik, A. A. (2014). A systematic review of air pollution as a risk factor for cardiovascular disease in South Asia: Limited evidence from India and Pakistan. *Inter J. of Hyg. and Environmental Health*, **217**(2-3), 133-144.

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