

## AIR POLLUTION INDUCES RESPIRATORY DISEASES IN BANGLADESH: A PERCEPTION BASED STUDY

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### ABSTRACT

Air pollution has an enormous effect on respiratory health problems. This study used an online, standardized questionnaire to assess individuals' views of respiratory diseases caused by air pollution by the utilization of an online. Distributed 325 questionnaire to participants using Google Forms. The analysis utilized statistical methods, such as descriptive statistics and a Chi-Square test, to evaluate the responses. Out of the participants, 258 were male, and the largest number of males (121) fell into the 31-40 age category. The urban population consisted of 146 individuals, the majority of whom relied on employment outside of the government sector. The findings indicated that 37% of the participants perceived the ambient air quality as highly detrimental to health, while 26% recognized air pollution as a contributing factor to respiratory illnesses. Significantly, 16% of the individuals had asthma, 3.7% were afflicted with COPD, and 43% encountered respiratory challenges. A notable 56% voiced apprehension regarding the influence of air pollution on respiratory well-being. Study discovered the combustion of fuel, insecticides, fertilizers, garbage, industrial pollutants, and dust generated from construction activities as the primary causes of pollution. Finally, the study emphasizes the immediate necessity for timely solutions and efficient monitoring to reduce air pollution in Bangladesh.

**KEYWORDS:** air pollution, respiratory disease, health impact, people's perception and Bangladesh.

### INTRODUCTION

Air pollution is now a severe problem for developing countries, which has a serious toxicological impact on human health and the environment (Majumder et al., 2023). The impact of air pollutants on the respiratory system has been widely and consistently reported in recent years. The short-term effects include decreases in pulmonary function, increases in inflammatory markers and respiratory symptoms, exacerbations of chronic obstructive pulmonary disease (COPD) (Sweileh et al., 2018). Bangladesh is a major developing country with rising levels of air pollution from industrial and traffic emissions coupled with manmade phenomena. Air pollution Bangladesh is mainly different from that in developed countries in terms of its magnitude (Nayeem

et al., 2020; Rahman et al., 2019). Air pollutant emissions and the resulting health disease have increased annually since reevaluation of industrialization and urbanization (Begum et al., 2014). There is increasing evidence that the most common air pollutants (PM, O<sub>3</sub>, NO<sub>x</sub> and SO<sub>2</sub>) adversely affect the respiratory health of human (Colarusso et al., 2019; Bakonyi et al., 2004). It is estimated to contribute toward 7 million premature deaths a year, while 92% of the world's population are estimated to breathe toxic air quality (IQAir, 2023; WHO, 2016). Bangladesh in 2017; air pollution contributes to almost 5 million deaths globally, nearly one in every 10 in 2017 (HEI and IHME., 2019). On the other hand, within 10% respiratory infections and diseases in Bangladesh occur due to urban air pollution

(World bank., 2006). It reduces the Forced Vital Capacity (FVC), Forced Expiratory Volume (FEV) 1, FEV 1 / FVC%, and Peak Expiratory Flow Rate (PEFR) of people especially children (Akhter, et al., 2012). People who are living in ambient air and indoor air both are affected by air pollution (Nayeem et al., 2020; Nahar et al., 2016). Vehicle emission causes Chronic Obstructive Pulmonary Disease (COPD) (which is a type of obstructive lung disease characterized by long-term breathing problems and poor airflow) of traffic policemen as they are exposed to in a long time (Ahmed et al., 2016). The adverse effects of air pollution is more detrimental to children, since for an adult the effects are more likely to be an inconvenience but to children it is also a matter of their development. In childhood, the lungs keep on developing which is why children breathe more air, and that too rapidly. Thus, the quantity of toxicant children takes in, are far more. Due to air pollution respiratory problems among school children in Dhaka cities are found (Woo et al., 2018). However, some people are exposed to long term and some in the short term. Heavy metals cause severe diseases such as lung cancer, asthma, bronchitis, tuberculosis, kidney damage, high blood pressure, birth defects, etc. because of long persistence in nature and bioaccumulation in the food chain (Rahman et al., 2019; Bhuyan and Islam, 2017 and Shandiz and Talasaz, 2017). On the other side Particulate matter effects, the cognitive function of children by changing the brain structure, Blood Lead level due to heavy metals Reduce Child Brain Development (Woo et al., 2018).

## MATERIALS AND METHODS

### Study Design and Sample Size

The study employed a cross-sectional design to obtain qualitative data using questionnaires. The questionnaires were self-administered and were paraphrased into the English language for respondents. The content and face validity of the questionnaire were determined by a panel of experts before and after pretesting. Three hundred twenty-five (325) respondents were taken for this study.

### Data Collection

This study took place in 2020. A standardized structured online questionnaire through Google Form designed to meet the objectives of this research was used for data collection. Prior to data collection, respondents' verbal was sought. Respondents were informed about the

purpose of the study and were made to understand that participation was voluntary. The study respondents were assured of confidentiality. Personal identifiers were removed after data collection in the summary data to ensure confidentiality. Ethical clearance was obtained from the Ethics Review Committee (ERC) of Department of Environmental Science, Stamford University Bangladesh.

### Data Analysis

The data from the completed surveys were analyzed using SPSSv20 and Excelv13. Analysis involved with two steps: (1) descriptive statistics (e.g. frequencies, mean, and standard deviation) were used to describe the respondents and their responses on various survey items. (2) a chi square test to establish relationships between the outcome variable of air pollution impacts on respiratory health and the independent variables.

## RESULTS AND DISCUSSION

The respondent's demographic details are displayed in Table 1. Majority portion (79.4%) of the respondents are male, while females constitute 20.6%. This indicates a significant gender disparity among the respondents. The age range covered was  $\leq 11-20$  to  $\geq 50$ , with the majority (37.2%) falling between 31 and 40 years old. The age group with the highest proportion of respondents is 31-40 years, making up 37.2% of the total. The second largest age group is 41-50 years, comprising 30.9% of the respondents. The age group of 21-30 years constitutes 21.5% of the respondents, whilst the youngest age group (11-20 years) and the oldest age group (51 and beyond) represent lesser numbers, specifically 2.2% and 7.2% respectively. The largest occupational group consists of non-government employees, accounting for 44.9% of the total. They are followed by individuals working in business, making up 16.0%. Additional noteworthy categories consist of housewives, accounting for 11.7% of the total, individuals with undetermined vocations, making up 10.5%, and doctors, representing 7.1%. The sample consists of smaller groups of government job holders (5.2%) and students (4.6%). The demographic distribution of the respondents reveals that the majority of the group consists of middle-aged males who have different professional backgrounds. Additionally, a large proportion of the respondents are employed in non-governmental positions.

**Table 1: Demographical characteristics of the respondents (N=325).**

	Frequency	Percent (%)
<b>Gender category of the respondents</b>		
Male	258	79.4
Female	67	20.6
<b>Age category of the respondents</b>		
11-20 Years	7	2.2
21-30 Years	70	21.5
31-40 Years	121	37.2
41-50 years	100	30.9
51 above	23	7.2
<b>Occupation of the respondents</b>		

Business	52	16.0
Doctor	23	7.1
Government Job	17	5.2
Non-Government Job	146	44.9
Housewife	38	11.7
Student	15	4.6
Others	34	10.5

It has been reported that 37% respondents consider that the condition of ambient air pollution has extremely unhealthy where 29% said it's in very unhealthy condition, and 30% opine that it's on unhealthy conditions (Figure 1). Only 4% believe its ambient air is healthier. It is found in figure 2 that 67% respondents said they did not have any respiratory problem; 26% respondents agree that air pollution induced in respiratory disease. About 90% of deaths due to air pollution in the South Asia region occur in low- and middle-income countries (Sweileh et al., 2018). The table presents the distribution of respiratory diseases among 325 respondents. Most participants, 73.2% (238 individuals), reported no respiratory problems. Of those with respiratory conditions, asthma was the most common, affecting 16.0% (52 individuals) of the sample. Other conditions reported include bronchitis (4.9%, 16 individuals), chronic obstructive pulmonary disease (COPD) (3.7%, 12 individuals), and combinations of asthma with other conditions such as bronchitis (0.6%, 2 individuals), COPD (0.9%, 3 individuals), and lung cancer (0.6%, 2 individuals). Traffic-related air pollutants (TRAP) is mostly associated with the development of asthma everywhere and it has been widely accepted that the acute health effects in individuals with pre-existing COPD may be caused by air pollution (McConnell et al., 2010; Bloemsma et al., 2016). Figure 3 shows that respondents have breathing difficulties when they go outside from home. However,

43% of respondents have breathing difficulties, whereas 35% respondents don't face any difficulties. Among the respondents, 23% used inhalers regularly, whereas 12% respondents use sometimes. Almost 65% of respondents don't use it. Figure 4 depicts the respondents' perceptions of the impact of air pollution on respiratory health. Based on the statistics, 56% of participants hold the belief that air pollution has a substantial impact on respiratory problems. By comparison, 29% of participants believe that air pollution could potentially affect their respiratory health, while 15% do not perceive air pollution as a catalyst for their respiratory issues. Figure 5 presents the frequency of medication used among respondents for respiratory and airborne diseases. It indicates that 23% of participants use medication regularly, 29% use it occasionally, and 48% do not use any medication. Figure 6 details the frequency of doctor visits in 2019 related to respiratory and airborne diseases. It shows that 48% of respondents visited a doctor 1-5 times during the year. Additionally, 11% visited 5-10 times, and 1% visited more than ten times. Notably, 40% of individuals with respiratory or airborne illnesses did not visit a doctor at all in 2019. The study also highlights hospitalization trends for respiratory and airborne conditions in 2019. It found that 20% of respondents were hospitalized 1-5 times, while only 1% were hospitalized 5-10 times. The majority, 79%, did not experience hospitalization during the year.



Figure 1: Opinion about the Quality of Air in Bangladesh

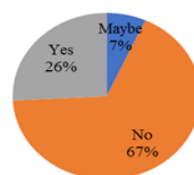


Figure 2: Perception about Respiratory Problems

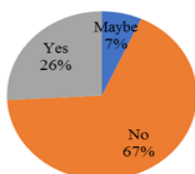


Figure 3: Breathing Difficulties When You Go Outside

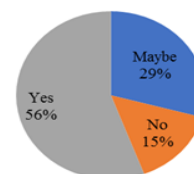


Figure 4: Air Pollution Triggers Your Respiratory Problems

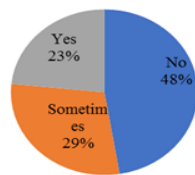


Figure 5: Medicine for Respiratory & Airborne Diseases Regularly

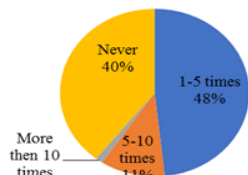


Figure 6: Visit Doctors Due to Respiratory & Airborne Diseases in the Year 2019

**Table 2: Types of respiratory problem of respondents.**

Disease	Frequency	Percent	Cumulative Percent
Asthma	52	16 %	16.0
Asthma, Bronchitis	2	0.6 %	16.6
Asthma, COPD	3	0.9 %	17.5
Asthma, Lung Cancer	2	0.6 %	18.2
Bronchitis	16	4.9 %	23.1
COPD	12	3.7 %	26.8
No problem	238	73.2 %	100.0
<b>Total</b>	<b>325</b>	<b>100.0</b>	

Table 3 demonstrates Chi-Square test. The analysis reveals significant associations between demographic factors and health outcomes related to air quality in Bangladesh. Gender strongly influences opinions on air quality, while age is a significant factor in respiratory health, affecting the occurrence of problems and the use

of inhalers. Although occupation shows a marginal association with opinions on air quality, it does not significantly impact willingness to pay for air pollution mitigation. Overall, demographic factors play a crucial role in shaping experiences and attitudes toward air quality and respiratory health in Bangladesh.

**Table 3: Chi-Square test (Hypothesis)**

	Vale	df	P value (95% CL)
<b>Opinion about the quality of air in Bangladesh</b>			
Age	6.9	3	0.075
Gender	48.40	18	0.000
Occupation	56	33	0.070
<b>Age</b>			
Respiratory problems	25.68	12	0.012
Types of respiratory problems	136	36	0.000
Breathing difficulties	17.74	12	0.124
Taking inhaler regularly	33.64	12	0.001
<b>Air Pollution trigger up respiratory problems</b>			
Existing respiratory problems	80.67	4	0.000
<b>Willingness to pay to combat air pollution</b>			
Occupation	61.42	55	0.250

Worldwide air pollution is a threat because of its tremendous effects on respiratory (Nayeem *et al.*, 2020). A long period of time if polluted air is absorbed by the human body during inhalation, it slowly affects respiratory system. People who suffer from respiratory disease, in maximum cases can understand at the trimester stages of disease (Manisalidis *et al.*, 2020). Another study found that respondents suffered from respiratory diseases such as, asthma (20%), bronchitis (10%) and others (6%) problems (Tusher *et al.* 2018). Though air pollutants are linked to a range of health issues, including eye irritation, headaches, kidney damage, central nervous system harm, skin cancer, cardiovascular diseases, nausea, asthma, and anemia (Alam *et al.*, 2018). This broad spectrum of health concerns underscores the critical need to address air quality to mitigate its adverse effects. Again, different studies found relationship between particulate matter concentrations (PM<sub>10</sub> and PM<sub>2.5</sub>) and peak expiratory flow rate (PEFR) in children, both asthmatic and non-asthmatic (Ahmad *et al.*, 2008). Their study found that increases in PM<sub>10</sub> and PM<sub>2.5</sub> concentrations are associated with significant reductions in PEFR, with variations observed between morning and afternoon measurements and between dry and wet seasons. This highlights the

impact of air pollution on lung function and the variability in effects based on environmental conditions. Different studies emphasize that air pollution's health effects extend beyond respiratory symptoms to include associations with preterm birth, infant mortality, impaired lung growth, and potentially the development of asthma (Ali *et al.* 2006). About 4.5 million deaths worldwide were connected to outdoor air pollution exposures and another 2.2 million deaths were caused by indoor air pollution (State of Global Air, 2019). Air pollution can be defined as a mixture of gaseous, liquid, and solid substances containing many toxic components which include CO, NO<sub>2</sub>, SO<sub>2</sub>, O<sub>3</sub>, Pb, polycyclic aromatic hydrocarbons (PAH), and particulate matter (PM) (WHO 2005). Particulate matter is a mixture of particles and droplets in the air, consisting of a variety of components such as organic compounds, metals, acids, soil, and dust (Ciencewicki *et al.*, 2007). Particulate Matter (PM), particles of variable but very small diameter, penetrate the respiratory system via inhalation, causing respiratory disease and may lead to death (Manisalidis *et al.*, 2020). Particulate matter (PM<sub>2.5</sub>) is a lung-damaging tiny particle. According to WHO, the safe limit of PM<sub>2.5</sub> is 15 micrograms per cubic meter for outdoor air. From substantial evidence it has been found



that PM<sub>2.5</sub> is independently implicated in respiratory diseases, and cancer and considering its ability it can reach terminal bronchioles and alveolar structures. (Siddiqui *et al.*, 2020). Many studies have discussed the effects of air pollution on the respiratory system. Almost all studies focused on indoor and outdoor air pollution and its severity in human health. Respiratory diseases occurring from air pollution include respiratory problems such as Chronic Obstructive Pulmonary Disease (COPD), asthma, bronchiolitis, and lung cancer. According to data from the Directorate General of Health Services (DGHS), an alarming number of patients paint a picture of a country's poisoned air. National Institute of Disease of Chest and Hospital (NIDCH) claims that about 7 million people in Bangladesh are affected by asthma and half of them are children (Shakeel *et al.*, 2017). In 2014, the World Health Organization (WHO) reported that lung cancer deaths reached 9,660 in Bangladesh, which is a staggering 1.3% of the total deaths in Bangladesh for the previous year. The present study found that the respondent said 16% respondent were faced asthma (Table 2). This study found about 43% people suffered from respiratory difficulties and it declares that air pollution is increasing. Air pollution is responsible for death estimated about 2.7 to 3.0 million people every year in the whole world, and 6% of all annual deaths. About 9 deaths out of 10 people due to air pollution take place in the developing countries, where about 80% of all people live (Shakeel *et al.*, 2017).

#### CONCLUSION AND RECOMMENDATION

Air pollution has become the second leading risk factor for death worldwide, contributing to 8.1 million deaths in 2021 (HEI and IHME., 2024). This study focuses on a critical problem of contemporary issue that, how air pollution affects respiratory functions. Among the respondents, 26% acknowledged that air pollution causes respiratory diseases. Specifically, 16% (52 individuals) reported having asthma, while 3.7% were discovered to be suffering from COPD. A significant majority of 73.2% of the respondents were not familiar with any respiratory condition. However, 43% of the respondents experience respiratory issues. A study revealed that 80.3% of respondents are willing to devote less than 5% of their yearly earnings towards efforts to combat air pollution, while only 2.8% are willing to allocate 10-15% of their annual income for the same purpose. Only 0.6% of respondents are willing to allocate more than 25% of their annual salary towards mitigating air pollution. A study has revealed that 20% of the respondents were admitted to the hospital 1-5 times in 2019 as a result of respiratory and airborne infections. There is a substantial correlation between the basic concept of air pollution in Bangladesh and the respondent's age, gender, and occupation. Furthermore, the age of the respondent significantly influences their perception of the respiratory health effects of air pollution. To effectively bring pollution under control, it will be necessary to implement measures such as the effective enforcement of laws, the reduction of political

influence during mobile court operations, the establishment of efficient government monitoring cells, and the raising of public awareness. Educate individuals on how to reduce their exposure to air pollution and raise awareness among the general public; this initiative can begin in a specific region and eventually spread across the entire nation. Everyone needs to be aware of this issue and its detrimental effects on both our health and environment. We should avoid using vehicles that emit black smoke and instead opt for cycling. We should plant more and more trees for a greener environment. The most necessary steps are public awareness and government investment in this particular area to reduce air and dust pollution. Strong rules and regulations will eventually emerge, and their implementation has the potential to reduce pollution to a level that is sustainable. Human sincerity, motivation, planting, minimizing unplanned urbanization, and strictly shutting down defective vehicles and industries will all play a crucial role.

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#### CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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