

Parents' Perception of Air Pollution and the Impact of Air Pollution on the Health and Development of Children Aged 0-5 Years

By,

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A thesis submitted to Brac Institute of Educational Development in partial fulfillment of
the requirements for the degree of
Master of Science in Early Childhood Development

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Brac University
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Declaration

It is hereby declared that

1. The thesis submitted is my/our own original work while completing degree at Brac University.
2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The thesis does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I/We have acknowledged all main sources of help.

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Ethics Statement

Title of Thesis Topic: Parents' Perception of Air pollution and the Impact of Air pollution on the Health and Development of Children Aged 0-5 Years.

Student name: Tashnuva Rashid

1. Source of population: Parents of children aged 0-5 years
2. Does the study involve (yes, or no)
 - a) Physical risk to the subjects
 - b) Social risk
 - c) Psychological risk to subjects
 - d) discomfort to subjects
 - e) Invasion of privacy
3. Will subjects be clearly informed about (yes or no)
 - a) Nature and purpose of the study
 - b) Procedures to be followed
 - c) Physical risk
 - d) Sensitive questions
 - e) Benefits to be derived
 - f) Right to refuse to participate or to withdraw from the study
 - g) Confidential handling of data
 - h) Compensation and/or treatment where there are risks or privacy is involved
4. Will Signed verbal consent for be required (yes or no)
 - a) from study participants
 - b) from parents or guardian
 - c) Will precautions be taken to protect anonymity of subjects?
5. Check documents being submitted herewith to Committee:
 - a) Proposal
 - b) Consent Form
 - c) Questionnaire or interview schedule

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Abstract

Globally, air pollution is one of most urgent contemporary challenges where children are especially vulnerable when breathes polluted air because of their physiological immaturity. Since parents are the key to their children's safety, raising parents' awareness is essential to taking protective action for children against polluted air. This study explored the perception of parents of children aged 0-5 years on air pollution and the impact of air pollution on the health the development of children. To understand parents' knowledge, awareness and concern, a quantitative cross-sectional survey was conducted with 118 parents in urban Dhaka of Bangladesh. A structured questionnaire was developed and through online modality data was collected using purposive sampling. Findings show that parents are well aware of air pollution and its immediate health risks such as, respiratory problems and adverse pregnancy outcomes. However, parents were less familiar with the long-term health and developmental impacts of air pollution like, heart diseases, diabetes, cognitive impairment, mental health challenges in adulthood. Despite this, an overwhelming parents expressed serious concern and strong willingness to engage in public awareness initiative. They also seemed very worried about the current poor air quality of their area and showed interest in raising more public awareness on this critical issue.

Keywords: Air pollution; Parents Perception; Health effects; Developmental impact.

Dedication

I dedicate this work to my five years old daughter, whose immense patience was my motivation, and to my husband for his guidance and encouragement to embrace new challenges in life. I would also extend my gratitude to all my parents— my mother, father, mother-in-law and father-in-law for their unwavering support that made this journey smoothly possible.

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Table of Contents

Declaration.....	ii
Approval	iii
Ethics Statement.....	iv
Executive Summary	Error! Bookmark not defined.
Dedication (Optional)	vi
Acknowledgement	vii
Table of Contents	viii
List of Tables	x
List of Figures.....	xi
List of Acronyms	xii
Chapter I Introduction & Background.....	1
Introduction.....	1
Statement of the Problem.....	3
Purpose of the study.....	4
Significance of the study.....	5
Research Question.....	7
Operational Definition.....	7
Chapter II Literature Review	8
Chapter III Methodology	17
Research Approach and Design.....	17
Research Site.....	17
Research Participants	17

Sampling Procedure/Participants Selection Procedure	18
Data Collection Tool.....	18
Data Collection Method and Procedure	19
Data Management and Analysis	19
Validity & Reliability	20
Etical Issues	20
Limitations of the Study.....	21
Chapter IV Results/Findings & Discussion	22
Results/Findings.....	22
Discussion	33
Conclusion	38
Recommendations.....	40
References.....	42
Appendix 1 Research tool: Survey Questionnaire(English).....	50
Appendix 2 Research tool: Survey Questionnaire(Bangla).	58
Appendix 3 Consent Form (English).....	66
Appendix 4 Consent Form (Bangla).....	67

List of Tables

Table 1 Demographic characteristics of the participants	23
Table 2 Geographic distribution of parents by location.....	23
Table 3: Parents understanding on the causes of air pollution.....	26
Table 4 Population affected most by air pollution.....	27
Table 5 Frequency distribution of parents' concern and support for public awareness about air pollution and health impact.....	27
Table 6 Parents knowledge on the health impacts of air pollution on children.....	29
Table 7 Parental awareness of air pollution on early brain development	31
Table 8 Parental Willingness to participate in air pollution awareness programs by level of Concern about children's health and development.....	33

List of Figures

Figure 1 Age range distribution of the children.....	24
Figure 2 Distribution of sources of information on air pollution.....	25
Figure 3 Distribution of parents' perception of Dhaka's air quality	25
Figure 4 Parents understanding on the health effects of children.....	28
Figure 5 Perceived respiratory issues by parents	30
Figure 6 Perceived pregnancy risks by parents.....	30
Figure 7 Parents perception of the impact of air pollution on children's brain development, learning and long-term outcomes.....	32

List of Acronyms

WHO	World Health Organization
UNICEF	The United Nations International Children's Emergency Fund
PM	Particulate Matter
SOGA	State of Global Air
OECD	Organization of Economic Cooperation and Development
SDG	Sustainable Development Goal
COPD	Chronic Obstructive Pulmonary Disease
ADHD	Attention Deficit Hyperactive Disorder
GDP	Gross Domestic Product
CREA	Center for Research on Energy and Clean Air
CNG	Compressed Natural Gas
DNCC	Dhaka North City Corporation
DSCC	Dhaka South City Corporation

Chapter I: Introduction & Background

Introduction

In today's era of globalization, where economic development is advancing rapidly, huge pressure is placed on the environment and its surrounding ecosystem, leading to significant environmental hazards. Among these, air pollution has become an increasing concern and major environmental risk to public health and well-being. Harmful substances and toxic gases are released from vehicles, industries, domestic use, fossil fuel combustion, tobacco smoke and household products are polluting both ambient and household air. According to the WHO 2021 air quality guideline published by World Health Organization (WHO) in 2024 mentioned, 99% of people worldwide breathe air that is not safe.

Air pollution is currently a major global environmental hazard affecting human health. In the modern time, the exponential increase in ambient air pollution has led to growing concern, with numerous studies highlighting its alarming impact especially on children. Early childhood is a critical period when children are especially vulnerable to air pollution. Exposure to harmful pollutants can seriously affect their growth and well-being, with increasing pollution levels leading to both fatal outcomes and lasting health issues beginning in the womb (UNICEF, 2024). These impacts are causing negative developmental outcomes in their physical, cognitive, socio-emotional, behavioral and mental health, weakening their learning abilities, academic achievements and future productivity (Bogale et al., 2022; Eleanya Nduka & Jimoh, 2024; Campbell et al., 2023). Deadly air pollutants place an undue burden on vulnerable populations, including pregnant women, young children, the elderly, and individuals with underlying health issues (Lu et al., 2023).

Although air pollution affects the entire globe, children in developing countries face a disproportionate share of its risks due to rapid urbanization, industrial growth, and weak regulatory enforcement, challenges that are further compounded by poverty, limited healthcare access, delays in preventive care and timely remedial intervention (Tavella et al., 2024). Also, Bangladesh is witnessing a sharp rise in air pollution, with ambient air quality in urban areas reaching hazardous levels (Khatun et al., 2023). According to WHO (2024), the country recorded the second-highest air pollution levels globally which is frightening for the health and development of young children. Children need a healthy, hazard-free environment during their developmental years to support proper growth and development (Bearer, 1995). Parents, as key figures in their children's lives, must also understand the negative impact of air pollution on children's health and development. While the adverse impacts of air pollution are well-documented in numerous studies, understanding parents' perceptions is equally important to identify their knowledge and awareness, which can inform effective strategies to protect young lives. This study was further motivated by my own experience as a parent. During January and February of this year, when Dhaka the capital of Bangladesh fell into hazardous air quality levels, a short walk with my 4-year-old daughter made me realize that if I was struggling to breathe, children whose lungs are still developing, must be even more vulnerable. This motivated me to engage in understanding this rising health concern and to examine how parents comprehend and respond to this pressing issue.

Statement of the Problem

Air pollution is among the top four hazards for the health of children globally, along with other developmental setbacks, and adverse birth complications (Murray et al., 2020). Alarming, around 98% of the children below age 5 in the developing countries are breathing polluted air exceeding the WHO guideline limit, while 52% of children in developed countries face similar risk, which is also significant (WHO, 2019; Deng et al., 2021). Numerous studies have demonstrated that air pollution is associated with a variety of harmful health effects, both immediate and long-lasting, ranging from mild, undetectable changes in the body to serious, life-threatening illnesses and even death (Wang et al., 2019; Lu et al., 2022;). In 2021, UNICEF identified air pollution as the second highest cause of death among children below five years old, after malnutrition.

Neonate, infants and early age children, are remarkably susceptible to air pollution due to their physical immaturity, higher breathing rates than adults and rapidly developing immune, respiratory and neurological systems. Being exposed to air pollutants can lead to impaired organ growth, neurological damages, cognitive delays, cellular alteration, respiratory and cardiovascular diseases along with lifelong mental health challenges, ultimately restricting their potential and lifelong productivity (UNICEF, 2024). Even it can put pregnant women at a higher risk of experiencing birth complications, losing newborns, and having children with neurological and biological damages (Aguilera et al., 2023; Deng et al., 2021). A growing body of research highlights that acute respiratory issues are a major cause of child fatalities due to air pollution, accounting for 15% of global child deaths annually. The impact is greater in the developing countries due to weak health care facilities, low awareness, and costly treatment (Bogale et al., 2022). In Bangladesh, air pollution is responsible for acute lower respiratory infections that account for 40% of all deaths in children under the age of

five (SOGA, 2024). Health issues can cause children to miss school, affecting their learning and leading to long-term social and economic losses.

The severity of air pollution's impact on young children in rapidly developing countries like Bangladesh is deeply concerning, especially in urban areas like Dhaka, where pollution levels have consistently exceeded WHO guideline limits for over two decades (Pavel et al., 2021). It has become highly important to understand what parents know and are aware regarding this matter. Although a substantial amount of research has been done, very little is known what parents perceive about the health and developmental impact on children at early years due to air pollution. This aim of the study is to explore parents' knowledge and awareness of the ambient air pollution and its impact on the health and development of children under the age of five in Dhaka city.

Purpose of the study

The purpose of the research is to understand parents' awareness about air pollution and their knowledge on the health and developmental impacts air pollution can cause to children aged 0-5 years. Every day children are exposed to polluted air which damages their lung, heart and brain eventually shortening their lives. Urban air pollution is on the rise in developing countries, and by 2050, an estimated 70% of the world's children will live in cities, where ambient air pollution poses serious risks to their health and development (United Nations, 2019). In recent years, ambient air pollution in Bangladesh has significantly degraded, particularly in the capital, Dhaka. During January–February 2025, air quality reached its peak severity, remaining at hazardous levels for an entire month (Dhaka Tribune, 2025). If parents are aware of the impact of air pollution on children, then they can support their children with precautionary and

remedial steps. The study aims to understand parents' overall awareness of air pollution and the impact of air pollution on their children, especially during the first five years.

Significance of the study

The Lancet series on “Optimizing child health and adolescents’ health and development” highlighted that, although there has been an increasing effort to improve child health globally, environmental risks like air pollution is often overlooked in the discussion. Given the significant burden of disease and child mortality linked to environmental hazards, integrating these risks into policies, programs, and effective interventions could help protect one in every four children globally (Renshaw et al., 2022).

According to the Global Burden of Disease study, air pollution causes over 9 million deaths each year, with over 90% occurring in low- and middle-income countries. If these trends persist, it is projected to become the chief environmental cause of premature death globally by 2050 (OECD, 2012). The disease burden and fatalities since 2019 have been increasing among children under 5, and it tends to increase if the pollution levels keep on rising (Binagwaho et al., 2022). Premature death and illness in young children result in twice the potential years of life lost compared to adults. For instance, if a child dies or suffers severe health and developmental complications at age 2, it represents a loss of up to 68 potential years, based on a life expectancy of 70 years (Lee & Kim, 2018). Moreover, early-life illness can lead to a lifetime of poor health, reducing productivity and representing a significant loss to a country's human capital and development. In fact, air pollution poses a dire threat to the achievement of SDG 3: Good Health and Well-being, especially for young children and pregnant women, so

addressing this issue is therefore essential to protect maternal and child health and to ensure progress toward achieving SDG 3.

Bangladesh is one of most polluted countries, holding the top position for the highest concentration of particulate matter (PM) in air. Dhaka stands among the top three most polluted cities globally, and in 2025, it held the first position for 11 consecutive days, surpassing even Delhi and Lahore, which have historically been the most polluted cities in Asia (Dhaka Tribune, 2025). Rapid urbanization, the influx of migrants, industries, huge traffic, and chaotic construction projects are further exacerbating the pollution levels (Salamat Khandker et al., 2023). High concentrations of fine particulate matters (PM) found in Dhaka's air, are strongly linked to severe respiratory and other chronic health issues in children, putting their health and development at significant risk (Khatun et al., 2023).

Understanding parental awareness is essential for safeguarding children against the dangers of air pollution. This study seeks to explore how parents, living in one of the world's most polluted cities, perceive the impact of air pollution on their children's early health and development. The findings will inform the design of effective strategies, interventions, or programs aimed at protecting and nurturing children during these critical early years. This study will support policymakers in developing targeted policies and action plans to protect children from the harmful effects of air pollution—an urgent need, as the lack of effective policies could make air pollution the primary cause of premature death among children. Additionally, it will provide valuable insights for health professionals, environmentalists, early childhood specialists, researchers, and students, encouraging collaborative, interdisciplinary efforts to address this critical issue more comprehensively. While various studies in Bangladesh have examined the influence of air pollution on the health of children, however, there is a significant lack

of research exploring parental perception and awareness regarding the health and developmental impacts of air pollution on children aged 0–5 years. Addressing this gap is essential for designing effective, family-centered public health interventions, effective awareness campaign and actionable policies aimed at protecting children in their early, most vulnerable years.

Research Questions

1. What is the level of knowledge among parents of children aged 0-5 years about air pollution?
2. What do parents understand about the impact of air pollution on the health and development of children aged 0-5 years?

Operational Definition

Air pollution: Air pollution refers to the presence of harmful substances in the air—particularly particulate matter (PM), sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, and volatile organic compounds—that can negatively impact children’s health and development (Patil et al., 2020). There are two main types of air pollution: ambient (outdoor) air pollution, caused by emissions from vehicles, factories, waste burning, and construction activities; and household (indoor) air pollution, which primarily results from burning solid fuels such as wood, coal, or cow dung for cooking and heating purposes.

Parental perception: It refers to the parents' beliefs, awareness, and knowledge about the presence, causes, and effects of air pollution on their children's health and development.

Children aged 0-5 years: It includes children in mother's womb, new-born, infants and young children from conception to 5 years who are most vulnerable to the effects of air pollution as this time is the critical window of brain development (Gregory, n.d.)

Air pollution impact on health and development of children aged 0-5: includes any adverse effects such as respiratory diseases (e.g., asthma, pneumonia), developmental delays, cardiovascular issues or neurological impairments (e.g., cognitive problems, ADHD), as perceived by parents (Lu et al., 2023).

Chapter II: Literature Review

The literature review examines the sources of air pollution and the impact of air pollution on the health and development of children. It reviews global and Bangladeshi studies on how air pollution affects different aspects of children's lives.

Global Context:

While air pollution was traditionally caused by natural events such as volcanic eruptions and wildfires, it is now largely the result of human activities fueled by rapid technological development. In urban areas, various sources of pollution contribute to the release of harmful pollutants, including particulate matter (PM_{2.5} and PM₁₀), nitrogen dioxide (NO₂), carbon monoxide (CO), sulfur dioxide (SO₂) and ozone (O₃), and which are key sources of air pollution (Syama et al., 2025). According to the WHO, around 1.8 billion children under the age of 15, including 630 million under five are breathing polluted air that endangers their health and development (Kmietowicz, 2018). Every year, over 700,000 children under five worldwide lose their lives due to air pollution, with the majority (500,000) of these deaths attributed to household air pollution caused by burning wood, coal, and animal dung for cooking and heating, inadequate ventilation, prolonged cooking durations, and outdoor air seeping into the home. This issue is especially severe in Africa and South Asia, where exposure levels remain alarmingly high (UNICEF, 2024).

Impacts on Children's Health:

Young children are at a greater risk from air pollution because of their rapid breathing rate and smaller lung capacity, causing them to inhale more air, and more pollutants in proportion to their body size. Their proximity to the ground, where pollutant concentrations are often highest, increases this exposure. Moreover, since they

frequently breathe through their mouths, airborne pollutants can evade natural nasal filters and reach the lower respiratory tract, where they are quickly absorbed and can negatively affect multiple organs (Buka et al., 2006). Along with the respiratory issues exposure to pollutants during pregnancy and early years plays a critical role in developing cardiovascular disease, cancers, metabolic diseases and reproductive disorders in adulthoods and these issues can result even from a very low level of pollution, lower than what would typically affect adults (Daniel et al., 2020).

Respiratory Diseases:

Air pollution harms children's respiratory health, causing both acute and chronic issues. Pollutants like PM_{2.5}, PM₁₀, NO₂, SO₂, and O₃ are linked to higher rates of asthma, reduced lung function, impaired lung growth organ and several respiratory infections among children (Buka et al., 2006). In terms of asthma, it is well-established that short term exposure to polluted air can worsen symptoms who already have this condition, even non-asthmatic children are at risks of developing asthma due to long term exposure to these pollutants (Esposito et al., 2025). Early exposure can lead to long-term damage and increase the risk of diseases like Chronic Obstructive Pulmonary Disease (COPD) and lung cancer later in life (Buka et al., 2006). Another severe respiratory disease common among children associated with air pollution is pneumonia. Several meta-analyses have found that air pollution significantly increases hospital visits for asthma and pneumonia, with stronger effects observed in children than adults (Zhang et al., 2016). A 2015–2017 study in China also found that high air pollution levels were strongly linked to increased pneumonia and asthma hospitalizations in children under five (Zhou et al., 2023). Air pollution has also been linked to other respiratory illnesses in children, such as bronchitis, ear and nose infections, and allergic rhinitis (SOGA, 2024).

Cardiovascular Diseases:

Long-term exposure to both indoor and outdoor air pollution, starting in childhood, significantly increases the risk of cardiovascular disease throughout life. Air pollutants, particularly PM_{2.5}, can penetrate deep into the lungs, triggering inflammation that rapidly spreads throughout the body. These fine particles can enter the bloodstream, where they damage tissues and cells in the cardiovascular system by clogging arteries or directly impairing blood vessels, posing serious health risks (Kim et al., 2020). A review of 14 global studies on air pollution revealed that exposure to elevated pollutant levels during childhood raises the risk of high blood pressure in children and teenagers, as well as the chance of developing hypertension in adulthood (American Heart Association, 2021). Other studies have mentioned about ischemic heart diseases, cardiac arrest, stroke, and, type 2 diabetes in adulthood (Kim et al., 2020).

Stunned growth:

Epidemiological evidence indicates that children exposed to air pollution before and after birth are more likely to experience stunted growth, an irreversible condition linked to long-term physical and cognitive impairments. Pre-natal exposure to ambient air pollution can cause low birth weight which eventually cause child stunting. A study conducted in Bangladesh, where stunting rates are already high, found that children exposed to elevated levels of PM_{2.5} were 13% more likely to experience stunting compared to those in areas with the lowest exposure, as ambient air pollution continues to rise in developing countries (Goyal & Canning, 2017).

Impact on Children's Brain and Child Development:

Children's brains grow rapidly during the early years, from conception to age five—when up to 90% of brain development occurs and around 1,000 trillion neural

connections are formed by age three. This critical period of brain development begins immediately after conception, making both prenatal and postnatal exposure to air pollution potentially harmful to brain connectivity (Su et al., 2021). Pollutants can disrupt the brain's connectivity being a potential threat to a child's cognitive ability. A review of 126 studies found a strong connection between prenatal air pollution exposure and impaired cognitive and behavioral development in infants (Suades-González et al., 2015). As a result, increased prenatal exposure has been linked to poorer self-control in later childhood and reduced academic achievement in early adolescence (Isenaj et al., 2024). Further studies link such pollution to diminished IQ scores, attention deficits, memory impairment, motor skill delays, and increased aggression in children (Lopuszanska & Samardakiewicz, 2020). A cross-sectional study conducted in Ghana found that children aged 3 to 5 who were exposed to pollutants from solid fuel use were at a higher risk of experiencing developmental delays, particularly in socio-emotional and cognitive learning areas (Grippo et al., 2023). Additionally, prenatal and early exposure to air pollution may increase the risk of autism spectrum disorder, developmental delay and ADHD in children (Su et al., 2021). Prolonged exposure to air pollution can also lead to mental health challenges in adulthood, including anxiety, depression, suicidal thoughts, schizophrenia and other psychological disorders (Bhui et al., 2023).

Adverse Birth Outcome:

Several factors such as nutrition, lifestyle, and environmental conditions significantly influence pregnancy outcomes. Notably, even after controlling for factors like maternal weight, smoking, alcohol use, and nutrition, researchers have found that air pollution remains a major contributor to low birth weight and premature births where premature birth is the leading cause of newborns deaths (Ghosh et al., 2021). Pollutants can cross

the placenta during pregnancy, directly affecting fetal growth and development, and may lead to complications such as preterm birth, stillbirth, miscarriage and fetal growth restriction (WHO, 2018). A current study found that pregnant women—especially African-American mothers—exposed to extreme air pollution face a higher risk of giving birth to premature, underweight, or stillborn babies (Flavelle, 2020). Several studies have identified a significant association between exposure to pollutants during pregnancy and an increased risk of gestational diabetes, hypertension, and preeclampsia in expectant mothers (Hu et al., 2014). Babies exposed to high levels of pollution in the womb may be born with congenital heart defects, neonatal jaundice, lung defects, and weakened immune system development (Syama et al., 2025; Dadvand et al., 2011). According to the 2020 State of Global Air report, air pollution-related health issues contributed to the deaths of approximately 476,000 newborns within their first month of life in 2019 (Aguilera et al., 2023). That same year, exposure to both ambient and household air pollution—particularly to fine particulate matter (PM_{2.5})—was associated with around 6 million preterm births and 3 million low birthweight babies globally (Ghosh et al., 2021).

Other Health Impacts:

Both household pollutants and ambient air pollutants contain carcinogenic substances, and exposure to these during pregnancy or early childhood can raise the threat of developing cancer later in life. A significant body of research has linked in-utero exposure to traffic-related air pollution with a higher likelihood of acute childhood leukemia (WHO, 2018). Children exposed to high levels of ambient air pollution may experience altered immune function due to suppression of the body's natural defenses. Additionally, increased pollution creates haze, which reduces the amount of ultraviolet (UV) radiation reaching the Earth's surface and can impair the body's ability to produce

vitamin D. As a result, these children face a higher risk of vitamin D deficiency and rickets than those in cleaner environments (Buka et al., 2006). Recent research has suggested a link between traffic-related air pollution and childhood obesity. This is supported by an animal study where mice fed the same diet gained more fat and had higher insulin levels when exposed to polluted air compared to those in a cleaner environment (Jerrett et al., 2014).

Impact on the Society and Economy:

The health and developmental impacts of air pollution on children are well-documented. However, these risks also yield substantial socioeconomic costs. Air pollution related illnesses and premature deaths contribute to reduced productivity and higher healthcare costs. Health damages due to particulate matter, cost the global economy an estimated \$8.1 trillion GDP loss in 2019 (World Bank, 2020). Moreover, study from China has shown that elevated pollution levels near schools significantly increase school absenteeism, further disrupting educational attainment and, over time, diminishing workforce readiness and long-term economic development (Chen et al., 2018).

Bangladeshi Context:

High concentration of pollutants in Bangladesh is responsible for the premature death, respiratory illness and poor birth outcome. According to the Center for Research on Energy and Clean Air (CREA), air pollution causes approximately 102,456 premature deaths in Bangladesh each year, including 5,258 children (Nesan et al., 2025). Common health issues observed among the children in Bangladesh include asthma, lung diseases, preterm births, and low birth weight. The 2024 State of Global Air (SOGA) report further highlights that in 2021, air pollution was responsible for over 19,000 deaths of

children under age five, along with an estimated 900,000 preterm births and 700,000 low-birth-weight babies annually in Bangladesh.

The country's rapid population growth, industrialization, commercial expansion, infrastructure development, and transition from an agriculture-based to an industry-driven economy have severely impacted the urban environment, resulting in a continuous decline in air quality (Roy et al., 2023). In recent years, major infrastructure projects—such as bridges, highways, and the metro—have significantly worsened air quality in Dhaka. Construction activities and road dust alone account for around 30% of the city's air pollution, while industries and factories contribute an additional 25–30% (Basak et al., 2025). Furthermore, approximately 8,122 brick kilns—with 1,000 to 12,000 located near Dhaka—combined with a sharp increase in registered vehicles from 1.49 million in 2010 to 5.11 million in 2022, contribute an estimated 15% of the total pollution. Other notable sources include waste burning (7%) and household cooking stoves (9%) (Khandker et al., 2023; Dhaka Tribune, 2025). Although the 2003 ban on two-stroke engines and the introduction of four-stroke and CNG-powered vehicles helped reduce emissions in Dhaka, it also led to a surge in the number of vehicles. Coupled with increased migration, this caused severe traffic congestion. As a result, even cleaner vehicles idling in traffic continue to release harmful pollutants such as carbon monoxide (CO), nitrogen oxides (NO_x), and particulate matter (PM), polluting the ambient air (Pavel et al., 2021).

In Bangladesh, household air pollution from biomass fuels used in rural and low-income urban areas contributes to under-five mortality, especially among neonates and infants who spend most of their time indoors. Despite overall declines in child mortality, the impact of using cooking fuels (like wood, dung, or coal) on child mortality has not changed much, it continues to be a contributing risk factor (Rana et

al., 2022). Despite the installation of improved cooking stoves in urban areas since 2013 to reduce household air pollution, a significant portion of the urban population still relies on solid fuels. This not only releases harmful pollutants indoors but also affects the outdoor environment, as air pollution is not confined to one space (Khandker et al., 2023).

According to Dhaka Tribune (2025), outdoor air pollution in Dhaka this year exceeded WHO guidelines by 33 times, comparable to smoking 1.7 cigarettes every day. This polluted air enters every house with windows and gaps impacting indoor air quality as well. Prolong cooking hour and poor ventilation is also worsening the indoor air quality of Dhaka 5 times worse than WHO guideline (Dhaka Tribune, 2025). A study in Bangladesh found that children aged 3–4 years exposed to pollutants from solid fuel burning at home were less likely to be developmentally on track, particularly in areas of cognitive and socio-emotional development (Rana et al., 2022). Air pollution poses a serious economic burden as well. By 2060, healthcare costs are projected to rise to approximately US\$176 billion. Additionally, the country faces an estimated annual loss of \$14 billion due to reduced productivity, premature deaths, and increased healthcare expenses (Khandker et al., 2023).

Chapter III: Methodology

Research Approach and Design

A cross-sectional quantitative approach was used in this research to gain insight into parents' perceptions of air pollution and impact of air pollution on children. This method is suitable as it captures data at a single point in time, providing a clear picture of parents' knowledge, awareness levels, and concerns regarding air pollution and its health and developmental effects on children (Maier et al., 2023). It allows for the quantification of variables, making it possible to measure and compare levels of awareness, identify which groups are more affected, and conduct statistical analysis to draw meaningful conclusions. This study involved the development of a structured survey questionnaire, allowing data to be collected efficiently from study sample. The responses were quickly and systematically analyzed to gain valuable insights into the population's understanding and perceptions about the issue.

Research Site

The research was conducted across various urban areas of Dhaka to ensure a comprehensive picture of parental perspectives. The locations were listed under the two distinct jurisdictions of Dhaka North City Corporation (DNCC) and Dhaka South City Corporation (DSCC). Key locations included Uttara, Mohammadpur, Rampura, Bashabo, Gulshan, and Dhanmondi, Gendariya and others.

Research Participants

The study included 118 participants, comprising both mothers and fathers of children aged 0–5 years. Due to time constraints, only 118 parents were chosen and the research focused on parents from middle- to upper-middle-income backgrounds. According to

Household income and expenditure survey, middle income family's monthly household income range is 30,000 -1,50,000 BDT and around 25-30% of population fall in this income bracket (BBS, 2023). This demographic was selected due to time limits, which limited the ability to reach a more diverse population.

Sampling Procedure/Participants Selection Procedure

For this study, purposive sampling technique was used. Purposive sampling was used to select parents who meet the inclusion criteria, parents of at least one child aged 0-5 years from middle-upper middle class socioeconomic background. An initial sample size of 196 was determined following the formula.

$$n = \frac{pqz^2}{e^2} = n = \frac{0.5 \times 0.5 \times (1.96)^2}{(0.07)^2} = 196, n = \text{sample size}$$

p=proportion of the participants who wants to participate 50% or 0.5

q= 1-p or 1-0.5=0.5

z= z score at 95% of confidence level is 1.96

e= margin of error= 7% or 0.07

However, during the data collection period a total of 118 responses were collected.

Data Collection Tool

A structured survey questionnaire was developed through a comprehensive review of existing literature on air pollution surveys along with the guidance from the supervisor. The questions were thoughtfully designed to align with the study's objectives, ensuring they effectively capture key aspects of the research questions, specifically, parents' knowledge and awareness of air pollution and its impact on children's health and development. Questionnaire was divided into three main sections: (i) demographic

information, (ii) parents' knowledge of air pollution, and (iii) parents' awareness of the impacts of air pollution on child health and development.

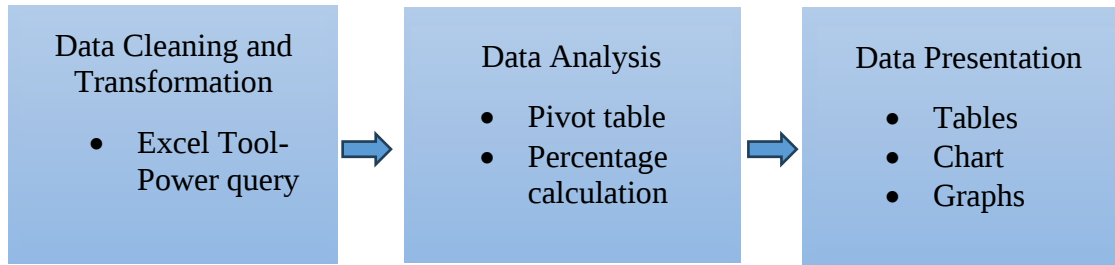
Data Collection Method and Procedure

An online data collection approach was adopted, where data was collected through digital platform primarily through Facebook and WhatsApp. Parents were provided with URL link to access the questionnaire. After clicking the links parents were shown a consent form which mentioned about the study objective, purpose and assurance of data confidentiality. Only after they read and agreed, they were redirected toward the actual questionnaire and if they disagreed to participate then the survey automatically ended there. For this modality, a Google Form was used to facilitate easy and accessible participation. The data collection was done from 1st July 2025 -20th July 2025. All participant information and responses were kept strictly confidential to ensure privacy and ethical standards.

Data Management and Analysis

For data analysis, Microsoft Excel was used. Online responses collected through Google Forms was saved in Google Sheets and then exported to Excel. To maintain data accuracy, all entries were cross-checked carefully. Since the study was conducted online, the collected data was carefully reviewed cleaned to ensure accuracy and reliability. The data set was cleaned and organized the multiple answers using power query for better analysis. Based on research question, three sub themes for each were made which helped to better understand the findings. The collected data were analyzed using PivotTables in Excel to examine response frequencies and identify key patterns. Percentage calculations were done to quantify categorical distributions, and the results

were presented through tables, charts and graphs for clear presentation of findings. The steps are given below:



Validity & Reliability

Validity and reliability were ensured by carefully designing the questionnaire based on existing literature on air pollution surveys and with the guidance of the supervisor. The supervisor reviewed the questionnaire to confirm that the language and content aligned with the research objectives. Based on his feedback, a pilot study was conducted with 6 parents similar to our main participants. After their feedback, slight adjustment was done and then the final version was provided to all other participants.

Ethical Issues

Ethical approval was secured from BRAC IED, BRAC University. Parents were provided with informed consent. They were informed about the study's purpose, objective, their voluntary participation, and right to withdraw at any time. Participants' privacy was protected by removing any personal identifiers from the data. Parents were assured that their information will remain confidential and used exclusively for the purposes of this study. Maintenance of appropriate gestures and behavior during data collection was ensured. Additionally, data presentation was neutral and free from any

bias. Ethical considerations were rigorously followed throughout the research process to uphold integrity and respect for participants.

Limitations of the Study

There were some limitations in the research.

- A major limitation of the study was to reach its achievable sample size due to time constrain. The initial sample size determined was 196, however, 118 responses were collected during the data collection process which was 78 fewer than the determined one. The sample size was 39.8% less than the required sample size.
- The research provides a valuable insight into the perception of middle-income parents of children aged 0-5 years. However, a limitation for generalizability exists in the geographic distribution of the sample. The distribution was skewed with 82.2% of the participants from Dhaka North City Corporation and only 17.8% from Dhaka South Corporation. This distribution does not reflect the city's actual demographic split (58% North vs. 42% South), resulting in an underrepresentation of South Dhaka perspectives (Bangladesh Bureau of Statistics, 2022)
- The study's timeframe restricted participant from primarily to educated, middle-income parents, limiting opportunities to explore perspectives across diverse socioeconomic groups.

Chapter IV: Results/Findings & Discussion

This chapter presents the findings and discussion of the online survey conducted among parents of children aged 0–5 years, aiming to explore their understanding of air pollution and its perceived impact on children's health and development. The data are based on responses from 118 parents, collected through a structured questionnaire from 1st July 2025 -20th July 2025. The findings are organized into three key areas: the demographic profile of respondents, parents' knowledge of air pollution, parents awareness about the impact of air pollution on health of children, and parents understanding of air pollution's impact on children's development.

Results/Findings

The findings are organized into sections and presented using charts, tables, and pie charts for better visualization and understanding.

1. Demographics information:

Total 118 (n=118) responses were collected. Table 1 shows the demographic information of the responded participants. Out of 118 study participants, majority of them were mothers that is 80.5% (n=95) and 19.5% (n=23) were fathers. Participants were predominantly young to middle-aged, with more than half (54.2%) aged 26-33 years and 40.7% aged 34-41 years, resulting in an estimated mean age 33.6 years. Education levels were notably high, with 69.5% holding postgraduate degrees and remaining (30.5%) holding honors/Bachelor's degree. Employment status showed a predominance of private sector employees (54.2%), followed by homemakers (26.3%), business personnel (12.7%), freelancers (2.5%), government employees (2.5%), and unemployed individuals (1.7%). The gender distribution of the children was nearly equal, with 50.8% female and 49.2% male.

Table 1 Demographic characteristics of the participants

Demographic variables	Categories	Frequency (n=118)	Percentage
Gender	Female	95	80.5%
	Male	23	19.5%
Age Group	26–33	64	54.2%
	34–41	48	40.7%
	42–49	6	5.1%
Educational level	Honors/Bachelors	36	30.5%
	Postgraduates	82	69.5%
Occupation	Private sector	64	54.2%
	Homemaker	31	26.3%
	Business Personnel	15	26.3%
	Freelancer	3	2.5%
	Government worker	3	2.5%
	Unemployed	2	1.7%
Gender of their children	Female	60	50.8%
	Male	58	49.2%

The geographic distribution of the participants is represented in Table 2. Locations of the participants were categorized under the two distinct jurisdictions of Dhaka North City Corporation (DNCC) and Dhaka South City Corporation (DSCC). Most of the participants (n=97, 82.2%) came from areas under Dhaka North City Corporation (DNCC) whereas only a smaller proportion are from the Dhaka South City Corporation (DSCC) (n=21, 17.8%).

Table 2 Geographic distribution of parents by location

Area Included	Locations Included	Frequency (n=118)	Percentage
Dhaka North City Corporation (DNCC)	Uttara, Cantonment, Tongi, Dakkhinkhan, Gulshan, Banani, Niketan, Bashundhara, Aftab Nagar, Badda, Banasree, Mirpur, Mirpur DOHS, Mohammadpur	97	82.2%

Dhaka South City Corporation (DSCC)	Dhanmondi, Gendariya, Bashabo, Shahjanpur, Jatrabari	21	17.8%
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The pie chart (Fig:1) shows the age distribution of the children whose parents participated in the survey. The largest group (39%) belong to the 4-5 years age cohort, then 21% are from age 3-4 years. Children aged 1-2 years and 2-3 years each made up 15% of the total, while the youngest group (0-1 years) represented 10% of the total.

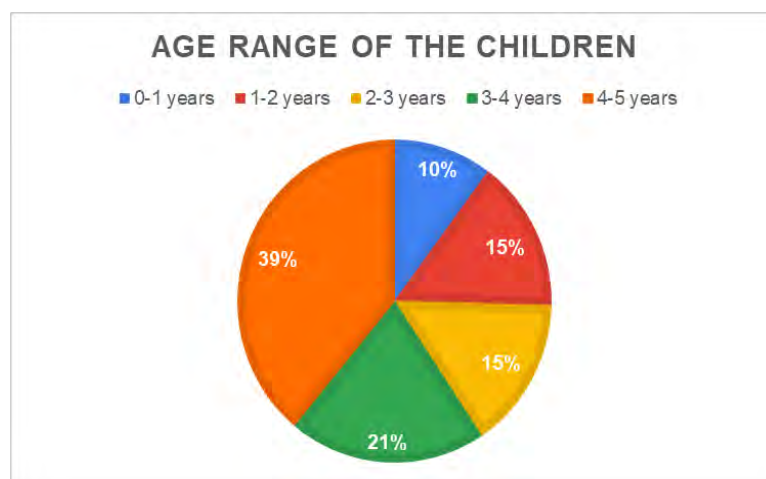


Figure 1 Age range distribution of the children

2. Parents Knowledge on Air pollution:

This section focused to understand parents' knowledge and understanding on Air pollution which is one of the main objectives of this paper by examining three main areas.

2.1 Awareness and Perception on Air pollution:

From the 118 respondents, 100% parents demonstrated awareness of the concept of air pollution and unanimously acknowledged its serious public health and well-being implications. Fig:2 shows that the parents mentioned about social media (64.4%) as the

primary source of information on air pollution followed by 60.2% came to know about air pollution from the internet. Other significant sources from where parents mentioned are schools/university/workplaces, newspaper and article/academic journals. Smaller proportions of parents mentioned about family/friends' (23.7%), TV/radio (22%) and websites (18.6%) respectively. On the other hand, a few parents (0.8%) referred to mobile apps, self-experience, and sustainability-related work are the reason of their knowledge on air pollution concept.

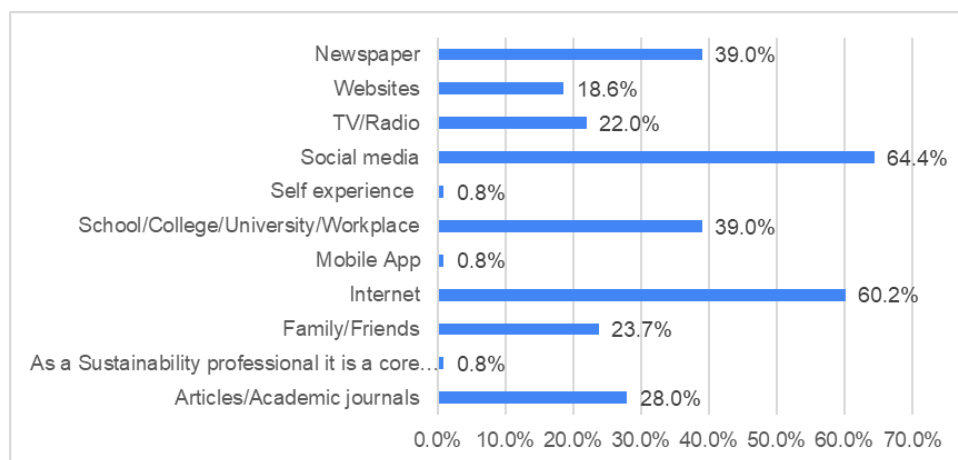


Figure 2 Distribution of sources of information on air pollution

Figure 3 illustrates parents' perceptions of Dhaka's air quality. Most respondents described the air as moderate (38%) or poor (32%), while 16% rated it as good and 13.5% considered it very poor.

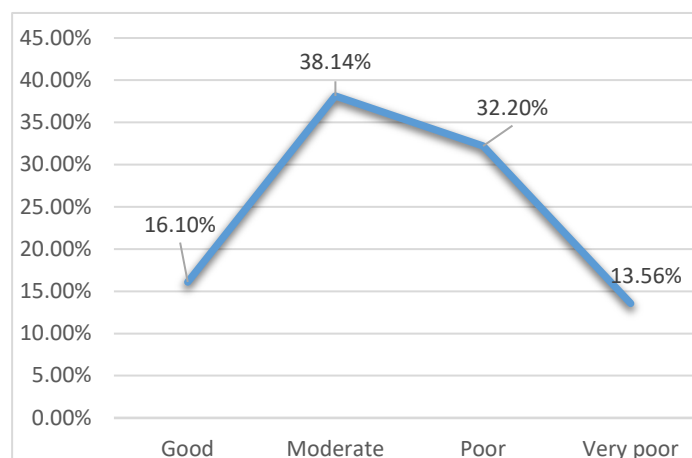


Figure 3 Distribution of parents' perception of Dhaka's air quality

2.2 Causes of Air pollution and the Vulnerability of Different Groups:

Table 3 presents parents' views on the major causes of air pollution. About 48.3% identified vehicle emissions as the primary source, followed by 41.5% who pointed to construction dust/infrastructural development. Additionally, 30.5 % attributed it to population influx in Dhaka. Around 35.9 % believed cigarette smoke and waste burning contribute to air pollution, while others mentioned brick kilns/factories (26.2%) and household cooking (9.3%) as contributing factors. However, 43.2% of parents felt that all these sources collectively cause air pollution. A small proportion also mentioned outdoor air conditioner units (1.7%) and fossil fuel burning (0.85%) as contributing sources.

Table 3: Parents understanding on the causes of air pollution

Responses	Frequency n=118	Percentage
Vehicle emissions	57	48.3%
Construction dust/infrastructural development	49	41.5%
Population growth	36	30.5%
Cigarette smoke	30	25.4%
Waste burning	31	10.5%
Brick kilns/factories	28	26.2%
Household cooking	11	9.3%
All of the above	51	43.2%
Outdoor air conditioner unit	2	1.7%
Fossil fuel burning	1	0.85%

As shown in Table 4, when asked which population groups are affected most by air pollution, 94.9% parents identified children, 64.4% mentioned the elderly and 44.1% said about adults.

Table 4 Population affected most by air pollution

Variables	Responses	Frequency(n=118)	Percentage
Population affected most by air pollution	Children	112	94.9%
	Elderly	76	64.4%
	Adults	52	44.1%

2.3 Parents' Attitude Towards Air pollution:

Table 5 illustrates 92.4% of parents mentioned being worry about air pollution. a small minority are either not worried (5.1%) or not felt it (2.5%) was their concern. When asked about the need to raise public awareness on air pollution, 84.7% of parents strongly agreed, 13.6% agreed, while only 2% remained neutral. An analysis of the concerned parents revealed that out of 109, a significant majority 95+13=108 (99.1%) parents, strongly agreed or agreed about the importance of increasing public awareness about air pollution. Interestingly, it was noticed that the worried parents n=109, tend to show stronger agreement (n=95) of increasing public awareness on air pollution.

Table 5 Frequency distribution of parents' concern and support for public awareness about air pollution and health impact

Variables	Public awareness needs to be increased (N=118)			
Parents concern about the poor air quality	Agree	Neutral	Strongly agree	Grand Total
Do not worry about	2	1	3	6 (5.1%)
No concern of mine	1	0	2	3 (2.5%)
Worry about	13	1	95	109 (92.4%)
Grand Total	16 (13.6%)	2 (1.7%)	100 (84.7%)	118

3. Parents Knowledge on the Health Impacts on Children caused by Air

pollution: This section will analyze what parents think about the different health complications and developmental outcome a child can face due to the effects of air pollution.

3.1 Health impacts on children:

Fig: 4 shows, 83% of the parents (n=98) thinks that air pollution can cause mortality and chronic health issues among children however, 3% believes it does not have any impact on children and 14% are not sure about this concept. In Table 6, when asked about the health-related problems of air pollution on children, parents demonstrated high awareness about the health risks, with a significant proportion recognized about respiratory risks (98.3%) and pregnancy related complications (89.8%). Awareness remains strong with direct physiological impacts like lung cancer (77.1%) and vit D deficiency (81.4%). However, it was noticed that understanding declines for some variables among the parents regarding future heart diseases (63.6%), childhood stunting (68.6%) and childhood obesity (50.8%). A small proportion of parents could associate air pollution with diabetes risks in later life (34.7%). Notably, diabetes, heart disease and childhood obesity showed significant uncertainty (55.1%, 34.7% and 33.1% "Not sure," respectively).

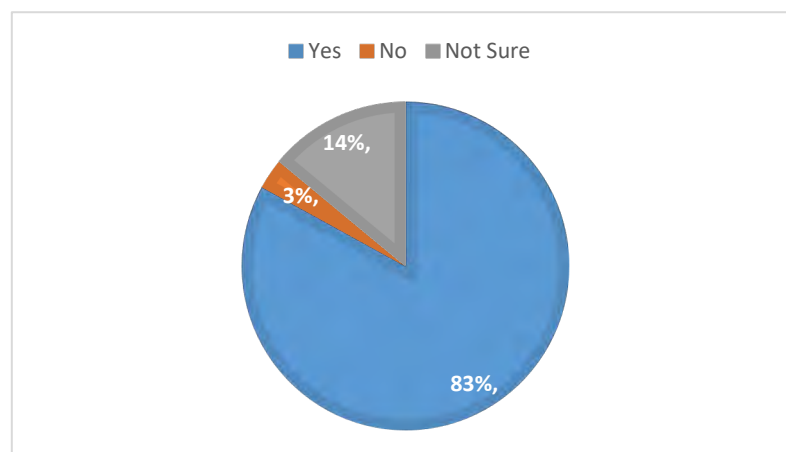


Figure 4 Parents understanding on the health effects of children

Table 6 Parents knowledge on the health impacts of air pollution on children

Health Risks Variables	Responses (n=118)		
	Yes n (%)	No n (%)	Not sure n (%)
Respiratory impacts in children	116 (98.3%)	0	2 (1.7%)
Future heart disease risk	75 (63.6%)	2 (1.7%)	41 (34.7%)
Lung cancer in adulthood	91 (77.1%)	1 (0.9%)	26 (22%)
Diabetes risks in later life	41 (34.7%)	12 (10.2%)	65 (55.1%)
Vit D deficiency and rickets in children	96 (81.4%)	2 (1.7%)	20 (16.9%)
Childhood obesity	60 (50.8%)	19 (16.1%)	39 (33.1%)
Childhood stunting	81 (68.6%)	4 (3.4%)	33 (28%)
Pregnancy risks	106 (89.8%)	0	12 (10.2%)

The findings tried to identify the types of respiratory issues that parents perceive children may experience due to air pollution. Figure 5 shows that asthma (58.2%) was the most commonly recognized condition by parents, followed by coughing and throat irritation (51.9%) and allergies (48.1%), each identified by nearly half of the respondents. Moderately, parents think air pollution can cause bronchitis (37%), frequent cold or infection (44.4%) and shortness of breath (36%). However, pneumonia (26.5%) and ear/nose infections (27%) showed lower awareness among the parents and very few parents mentioned about immune system suppression (2.1%).

The findings further tried to capture what are the pregnancy risks parents understand caused by air pollution. In Fig:6, almost half of the parents thinks that air pollution is linked to premature birth (47.5 %) and miscarriages (46.6%). Additionally, 40.7% of parents think air pollution is a reason of low birth weight. In contrast, only 28.8% of parents mentioned stillbirth as a potential outcome of air pollution. A notable proportion

of parents expressed their uncertainty (36.4%) about its association with pregnancy risks.

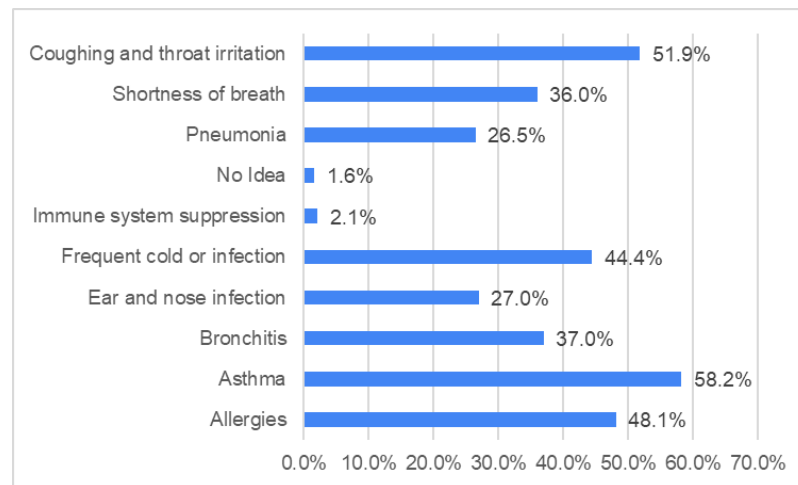


Figure 5 Perceived respiratory issues by parents

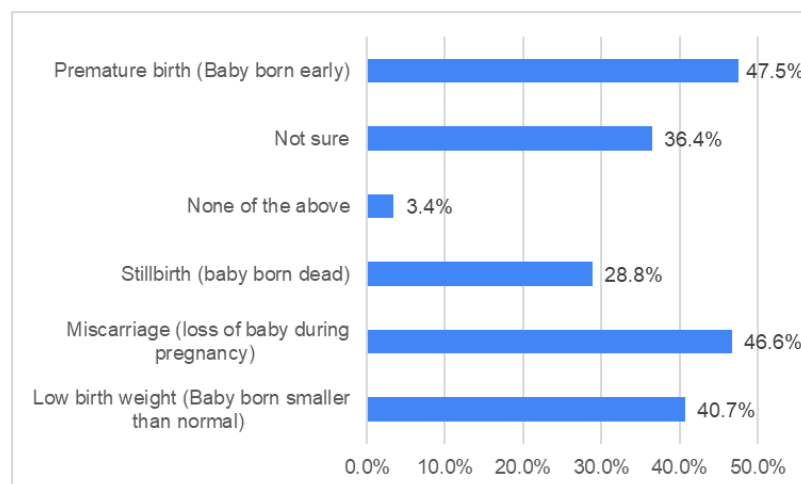


Figure 6 Perceived pregnancy risks by parents

3.2 Impacts on Brain Development, Learning, Long-term outcomes:

Table 7, shows, a strong majority of parents (77.1%) were aware that air pollution exposure during early childhood (including prenatal stages) can harm brain development, while 20.3% expressed uncertainty (“No Idea”). Only 2.5% denied this linkage.

Table 7 Parental awareness of air pollution on early brain development

Response	Count (n=118)	Percentage
Yes	91	77.1%
No	3	2.5%
No idea	24	20.3%

To gain deeper understandings into parents' knowledge of brain development including cognition, learning and long-term outcomes such as future productivity of children, a set of Likert scale question was used to better capture their perception. In Fig: 6, it was noticed that, a majority of the parents recognized the harmful impacts of air pollution in children development and future outcomes although the level of agreement varied among the responses. When asked whether air pollution can cause cognitive delays among children, 35.5% of parents strongly agreed and 40.7% agreed, while 22% remained neutral. Regarding the long-term consequences of air pollution on mental health in adulthood, 36.5% of parents strongly agreed and 38.1% agreed, with 21.2% of parents being neutral and a few parents disagreed (3.4%) with this statement. The highest agreement observed in the statement that pollution related health problems disrupt school learning through school absence, where 56.8% of parents strongly agreed and 40% agreed, with only 4.2% neutral and no disagreement reported. Similarly, about the long-term impacts of early life illnesses caused by air pollution on reducing children's future productivity and country's development, 41.5% of parents strongly agreed and 48.3% agreed, with 10.2% neutral and no disagreement was mentioned.

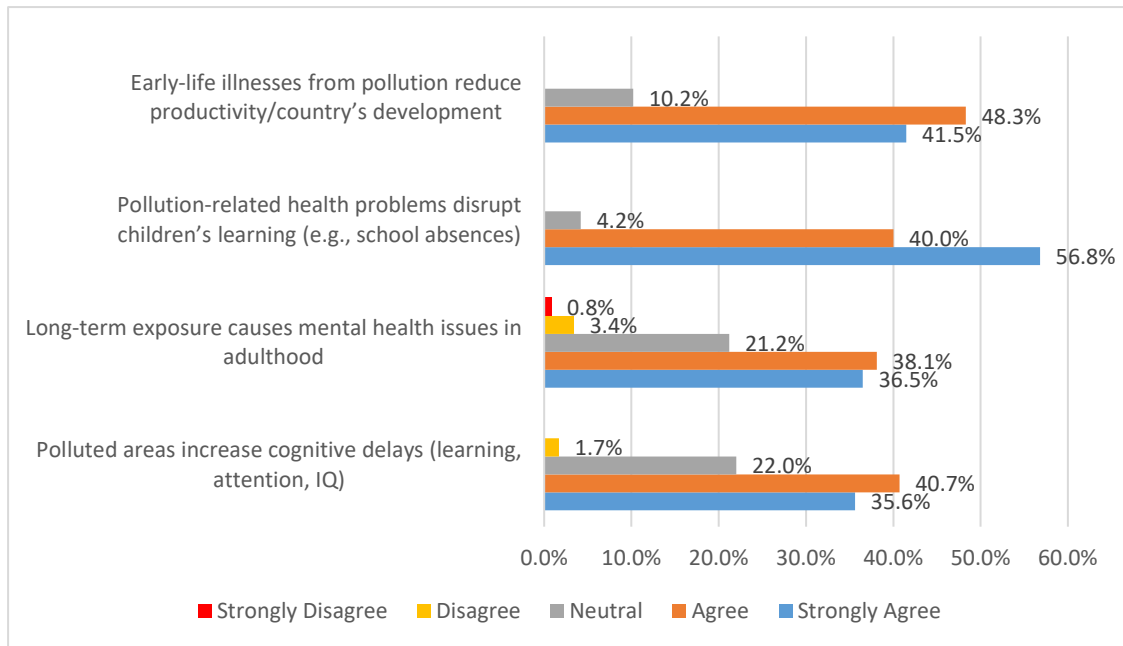


Figure 7 Parents perception of the impact of air pollution on children's brain development, learning and long-term outcomes

3.3 Severity and behavioral intent of parents:

Table 9, reveals a strong association between parental concern levels on children's health and development caused by air pollution and their willingness to participate in awareness program. Among 94 "very concerned" parents, the majority expressed willingness to attend in awareness program, with 49 (52.1%) committing to participate ("Yes, definitely") and 40 (42.6%) open to joining if convenient ("Maybe"). Only 1 (1.1%) was uninterested, implying collective acknowledgement from the parents. In contrast, all "not concerned" parents (n=3) showed strong willingness to attend awareness program. While "slightly concerned" parents showed mixed engagement (38.1% "Yes", 57.1% "Maybe"). Notably, the 52 (44.1%) "Maybe" respondents are "very concerned" about the impacts. (40/52, 76.9%).

Table 8 Parental Willingness to participate in air pollution awareness programs by level of Concern about children's health and development

Variables	Willingness to participate in awareness program				
Parents concern about children's health and development	Maybe, if it's convenient	Not Interested	Not sure	Yes, definitely	Grand Total
Not concerned	0	0	0	3 (2.5%)	3 (2.5%)
Slightly concerned	12 (10.2%)	0	1 (0.8%)	8 (6.8%)	21(17.8%)
Very concerned	40 (33.9%)	1(0.8%)	4 (3.4%)	49 (41.5%)	94(79.7%)
Grand Total	52 (44.1%)	1(0.8%)	5 (4.2%)	60 (50.8%)	n=118

Discussion:

Parents understating on Air pollution:

The study focused on understanding parents' perception of air pollution and its impact on the health and development of children under 5 years through a quantitative survey of 118 parents. The finding reveals critical pattern in how parents understand this issue and by contextualizing these findings within existing literature, this discussion identifies critical gaps in parental knowledge, examines prevailing attitudes and similarities, and guide us towards actionable pathways to safeguard early childhood development from air pollution impact.

All the parents (100%) are aware of the concept of air pollution and its serious implication on public health and wellbeing. As all the parents were educated with honors and post graduates' degree this collective awareness aligns with expectation, as individual with higher educational background are more likely to be informed about environmental and public health issues. The primary sources of their knowledge include

social media, the internet, schools/ colleges/workplaces, reflects the typical information channels accessed by educated demographics. So, higher education is associated with greater exposure to and engagement with diverse environmental information sources, which, as supported by other studies, makes individuals more aware of the risks posed by environmental pollutants (Daniel et al., 2020).

The findings show a negative perception of Dhaka's air quality among the educated parents with only 16% rating good while almost 80% rated as moderate (38.14%), poor (32.2%) and very poor (13.56%). This perception aligns remarkably with Dhaka's current (July 2025) Air quality index reading (AQI) the time when data was collected from parents which have consistently ranged between moderate and unhealthy for sensitive groups throughout the month (The Financial Express, 2025). While monsoon rains temporarily improved air quality (explaining the 16% good ratings), persistent pollution sources from vehicle, industries and construction keeps the air quality in suboptimal conditions. If this survey was done in winter when air pollution is worst, even more parents would likely say the air is very bad. Notably, moderate air quality poses serious risks to children as they inhale more pollutants than adults (Buka et al., 2006), suggesting that parents concern particularly among these educated demographics reflect a growing awareness of air pollution problem, no matter what season it is, underscoring a need for all year-round protective measure.

The study found parents identified vehicle emissions (48.3%) and construction dust (41.5%) as major pollution sources, consistent with Dhaka's primary pollutant contributors (Basak et al., 2025). While awareness of construction-related pollution was heightened due to ongoing metro/highway projects, identification of industrial sources like brick kilns (25.4%) remained strangely low despite their significant contribution to air pollution (Basak et al., 2025). This reveals a potential gap in public understanding

of less visible industrial pollution sources. Parents (30.5%) cited population growth as a source of pollution, highlighting its indirect impact through rising urbanization, more vehicles, construction activities, and greater energy demand (Roy et al., 2023). However, the relatively low recognition of household cooking (9.3%) as an air pollution source likely reflects the demographic background of respondents, who predominantly use clean fuels (e.g. LPG) rather than solid fuels common in rural and low-income settings (Khandker et al., 2023). Notably, 43.2% acknowledged air pollution as a multi-source issue, demonstrating complex understanding among parents. The study also reveals strong parental awareness of air pollution risks on children with 94.9% correctly identifying children as the most vulnerable group, aligning with WHO (2023) and UNICEF (2024) evidence which highlights children's heightened vulnerability due to their physiological immaturity. Notably, 64.4% of parents also recognized elderly vulnerability, consistent with another established research (Lu et al., 2023).

The findings to understand parents' attitude towards air pollution in Dhaka reveals overwhelming parental concern with 92.4% of respondents expressing worry and only 7.6% showing indifference. This heightened anxiety among parents aligns with the Dhaka's severe air quality crisis as Dhaka stands as the top three polluted cities worldwide (Dhaka Tribune, 2025). The almost widespread worry underscores how visible air quality degradation have made pressing concern for parents. If we look into the findings of increasing public awareness on air pollution and its impact it was seen, 84.7 % strongly agreed and 13.6% agreed which aligns with the broader literature, highlighting the importance of engaging and educating society about the multi-layered relationship of poor air quality and health. Study says that, awareness on pollution, its health impacts and practical preventive measures can motivate both behavioral change and policy support (Kelly et al., 2011). Notably, 99% of the worried parents wanted to

raise public awareness viewing it as essential for driving protective actions and policy changes to safeguard public health in Dhaka.

Parents understanding on the health and developmental impact in children:

The findings shows that the 83% of parents are aware that air pollution can cause death and severe health complications among children, although a small proportion are unaware of these risks. According to numerous studies, there is a strong connection of air pollution causing a range of health complications from mild to severe, both short term and long term and even death among children (Wang et al., 2019; Lu et al., 2022;)

Among the health complications, a significant parents recognized respiratory issues likely because these effects are both immediately observable. Since pollutants are inhaled directly into the lungs', educated parents were able to link air pollution to respiratory health problems, an understanding consistent with increasing scientific evidence connecting pollution to serious respiratory conditions among young children (Bogale et al., 2022). Among the respiratory issues most of the parents (58.2 %) mentioned about childhood asthma as a result of air pollution while 26.5% identified pneumonia. This aligns with several studies highlighting the development and exacerbation of childhood asthma due to exposure to air pollutants particularly particulate matters (Zhang et al., 2016; Lu et al., 2022). Although pneumonia is also linked to poor air quality, studies suggest that air pollution comparatively exerts a stronger effect on asthma than pneumonia. A longitudinal study in China found that children with asthma were more hospitalized than pneumonia when exposed to high levels of air pollutants (Zhou et al., 2023). Additionally, nearly half of the parents mentioned colds, coughing, and allergies, reflecting awareness of air pollution's short-

term impacts, which some literatures also link to immediate respiratory effects like bronchitis and wheezing. (Zhang et al., 2016; Wang et al., 2019).

Likewise, 89.8% of parents recognized pregnancy as a highly sensitive period, linking its risk to air pollution and nearly half of the parents in this study recognized the risks of pre term birth, miscarriages, and low birth weight as impact of air pollution during pregnancy. This aligns with wider evidences showing that pollutants can cross the placenta, disrupt fetal growth and lead to complications such as preterm birth, stillbirth, and growth restriction (WHO, 2018; Flavelle, 2020; Ghosh et al., 2021).

81.4% of parents mentioned about vit D deficiency and rickets among children which shows similarity with a study which shows particulate matter are independent risks to vit D deficiency (Buka et al., 2006). The study reveals significantly lower parental awareness of air pollution's metabolic effects, with only 50.8% linking it to childhood obesity and 34.7% to diabetes, likely because these conditions develop gradually after prolonged exposure (Kim et al., 2020). Unlike immediate respiratory symptoms, health consequences such as heart disease, and metabolic disorders often manifest years later, making the connection to pollution less apparent. The significant uncertainty identifying about the cardiovascular diseases and child stunting contradicts with actual scientific facts.

The findings on parents understating about the impact of air pollution on Brain development indicate a strong but inconsistent parental awareness, with 77.1% accurately acknowledging its risks a positive sign considering early childhood is a crucial stage where 90% of the brain development occurs, making this period especially sensitive to environmental pollutants (Su et al., 2021). A significant majority of parents (96.8%) acknowledged that pollution-related illnesses can interrupt children's

education through frequent absences, an issue supported by research linking high pollution levels near schools reducing attendance and academic achievement (Chen et al., 2018). Moreover, 89.8% of parents identified economic loss as an indirect impact, demonstrating awareness of air pollution's long-term societal costs, as highlighted in UNICEF and World Bank reports, including increased healthcare expenses and diminished national productivity (UNICEF, 2024; World Bank, 2020). However, the relatively low percentage of parents recognizing air pollution's impact on cognitive development and mental health highlights a gap in understanding. Despite widespread evidence linking pollution to neurodevelopment and psychological health (UNICEF, 2024), awareness of these critical areas remains limited among parents.

Finally, the findings reveal that the vast majority of parents (97.5%) are either very or slightly concerned about the health and developmental impacts of air pollution on their children, indicating widespread apprehension. There is a clear correlation between this concern and parents' willingness to participate in awareness programs. Notably, 94.9% of parents expressed interest in joining such programs, either definitely or if the other logistic factors are convenient for them to join. This suggests that organizing awareness sessions at the parents' accessible times and places would likely attract strong participation from concerned parents who are motivated to protect their children's well-being.

Conclusion:

Air pollution is a major global public health concern with serious impacts, especially on young children. This study explores how middle-income parents in Bangladesh perceive its health and developmental effects on their children, a highly vulnerable group due to early-life exposure. This study shows that parents in Bangladesh,

particularly those with higher education are acutely aware of air pollution's fundamental risks and its implications for child health. They demonstrate a good understanding of local air quality issues, with many recognizing that Dhaka's hazardous pollution levels pose a serious threat to young children. Their concern is not merely theoretical; it reflects a tangible awareness of the dangers posed by prolonged exposure to poor air quality during critical developmental stages. This underscores the urgent need for targeted public health initiatives that translate parental awareness into actionable measures to protect children's health.

While this study demonstrates strong parental awareness about air pollution's immediate health effects, it reveals an important gap in understanding about long-term developmental consequences. Educated parents show good comprehension of observable impacts and current air quality issues, yet deeper knowledge about how chronic exposure affects children's cognitive development, cardiovascular health, and overall growth potential remains limited. This finding highlights the critical need for targeted educational interventions that move beyond basic awareness to address the potentially irreversible impacts on children's futures. This highlights the need to explore and target their perceptions as well.

Finally, this study reveals not only parents' awareness of air pollution's risks but also their strong desire for deeper engagement and broader public address on this critical issue. Their willingness to learn more and advocate for change underscores an opportunity to transform individual concern into collective action. To effectively safeguard children's health, there is a clear need for comprehensive awareness programs and strategically designed initiatives that democratize access to knowledge across all communities.

Recommendations:

Based on the findings and discussion, the study offers key recommendations aimed at increasing parental awareness of the impacts of air pollution, with the goal of better protecting young children's health and development.

Raising Public Awareness:

The study highlights parents' strong agreement to raise public awareness on air pollution and its impact on children which shows us a way that more awareness program to make people aware. As highly educated parents lack in understanding about the air pollution consequences, there is an urgent need to develop program across all diverse communities protecting children from its harmful impact.

Designing targeted intervention:

As the study found, middle-income parents typically have greater access to digital platforms. Given their rigid working hours which is common in Dhaka, many may be unable to attend in-person programs despite their interest. Therefore, digital platforms can serve as an effective medium for delivering awareness programs, allowing parents to participate flexibly from any location, overcoming time and accessibility barriers.

Conducting more research:

While this study sheds light on one segment of the population, gaining a deeper understanding of parents' perceptions across different socioeconomic backgrounds both outside and inside Dhaka is also essential. Exploring the perspectives of rural and lower-income families, who often have limited access to digital platforms, will help in designing more inclusive and effective awareness programs. Further research in these

contexts is crucial to capture diverse viewpoints and address knowledge gaps more comprehensively.

Policy advocacy for protecting children from Air pollution:

Although policies exist to reduce carbon emissions and protect children from environmental threats, their implementation remains limited—reflected in the persistently high pollution levels in Dhaka. There is a serious need to strengthen policy enforcement through robust monitoring and the introduction of penalties for exceeding permitted pollution limits. Additionally, child-friendly policies must be integrated, with a particular focus on early childhood, recognizing the critical importance of this stage in shaping a healthy and productive future generation.

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Appendices:

Appendix :1 Research Tool: Survey Questionnaire (English)

Survey Questionnaire on Parents Perception of Air pollution and the Impact of Air pollution on the Health and Development of Children aged 0-5 years

Section A: Demographic information

1. Please mention your gender:
☐ Male ☐ Female
2. Your age:
☐ 18-25
☐ 26-33
☐ 34-41

- ☐ 42-49
- ☐ 50 and above

3. Please mention in which area of Dhaka City you live?

- ☐ Gulshan
- ☐ Banani
- ☐ Dhanmondi
- ☐ Uttara
- ☐ Mohakhali
- ☐ Mohammadpur
- ☐ Niketan
- ☐ Bashundhara
- ☐ Badda
- ☐ Rampura
- ☐ Others_____ (Please specify)

4. Please mention your highest level of education

- ☐ S.S.C
- ☐ H.S.C
- ☐ Honors/ Bachelor's degree
- ☐ Postgraduate
- ☐ No formal education

5. Please mention your occupation

- ☐ Government worker
- ☐ Private sector worker
- ☐ Business
- ☐ Freelancer
- ☐ Homemaker
- ☐ Unemployed

6. Please mention your approximate household income

- ☐ BDT 25,000 – BDT 39,999
- ☐ BDT 40,000 – BDT 49,999
- ☐ BDT 50,000 – BDT 59,999
- ☐ BDT 60,000 – BDT 69,999
- ☐ BDT 70,000 – BDT 79,999

- ☐ BDT 80,000 – BDT 89,999
- ☐ BDT 90,000 – BDT 99,999
- ☐ Above BDT 1,00,000

7. Do you have any children below 5 years?

- ☐ Yes ☐ No

8. Please mention your child's gender

- ☐ Male ☐ Female

9. Please mention the age range of your child

- ☐ 0-1 years ☐ 1-2 years ☐ 2-3 years ☐ 3-4 years ☐ 4-5 years

Section B: Knowledge on Air pollution

10. Are you aware of the concept of Air pollution?

- ☐ Yes ☐ No

11. What is your main source of information or awareness about air pollution?

- ☐ Newspaper
- ☐ TV/ Radio
- ☐ social media
- ☐ Internet
- ☐ Websites
- ☐ School/ College/ University/ Workplace
- ☐ Articles/ Academic journals
- ☐ Family/ Friends
- ☐ Others _____ (Please specify)

12. What do you think are the main causes of Air pollution in your area? (Multiple answers)

- ☐ Vehicle smoke
- ☐ Industrial emission/ Brick kiln
- ☐ Household cooking
- ☐ Waste burning
- ☐ Construction dust/ infrastructure development
- ☐ Population growth
- ☐ Cigarette smokes
- ☐ All of the above

- ☐ Others _____ (Please specify)
- ☐ Don't know

13. Do you think air pollution is a serious problem to public health and well-being?

- ☐ Agree ☐ Disagree ☐ Not sure

14. In your opinion who are the people seriously affected by air pollution?

- ☐ Children
- ☐ Adults
- ☐ Elderly

15. How would you rate the air quality in the community where you live?

- ☐ Very good
- ☐ Good
- ☐ Moderate
- ☐ Poor
- ☐ Very poor

16. How would you feel about the current degradation of air quality in your area?

- ☐ Worry about
- ☐ Do not worry about
- ☐ No concern of mine

17. Do you think public awareness about air pollution needs to be increased to help reduce pollution and protect people from its effects?

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree

Section C: Impact on Child Health

18. Children are more susceptible to air pollution than adults?

- ☐ Yes ☐ No ☐ Not sure

19. What do you think air pollution can cause mortality and chronic health issue among children from mother's womb?
- ☐ Yes ☐ No ☐ Not sure
20. Do you think air pollution can harm children's respiratory health causing both acute and chronic issues?
- ☐ Yes ☐ No ☐ Not sure
21. What types of respiratory issues do you think children can develop due to air pollution?
(select as many as you feel like)
- ☐ Coughing and throat irritation
☐ Asthma
☐ Pneumonia
☐ Frequent cold or infection
☐ Bronchitis
☐ Ear and nose infection
☐ Shortness of breath
☐ Allergies
☐ Others _____ (please specify)
☐ Don't know
22. Do you think early exposure to air pollution (during the first five years of life) can affect a child's lung development?
- ☐ Yes ☐ No ☐ Not sure
23. Do you think long term exposure to air pollution can cause lung cancer in adulthood?
- ☐ Yes ☐ No ☐ Not sure
24. Have you noticed any respiratory issues among your children in recent times due to air pollution?
- ☐ Yes ☐ No
25. Do you think long-term exposure to air pollution from early childhood increases the risk of heart related illness later in life?
- ☐ Yes ☐ No ☐ No Idea

26. Which of the following heart-related problems do you think can be caused by long-term exposure to air pollution? (select as many as you feel like)
- ☐ High blood pressure
 - ☐ Heart attack
 - ☐ Stroke
 - ☐ Irregular heart beat
 - ☐ Clogged arteries
 - ☐ Not sure
 - ☐ No heart related risk
27. Do you think that long-term exposure to air pollution can increase the risk of developing type 2 diabetes later in life?
- ☐ Yes ☐ No ☐ No idea
28. Air pollution can block sunlight and reduce Vitamin D production in children causing to vitamin D deficiency and rickets among children.
- ☐ Yes ☐ No ☐ No idea
29. Did you know that vehicle emissions, especially from heavy traffic, contribute significantly to air pollution and can affect children's health?
- ☐ Yes ☐ No ☐ No idea
30. Do you think traffic related pollution can increase the risk of childhood obesity?
- ☐ Yes ☐ No ☐ No Idea

Section D: Impact on pregnancy and new born health

31. Do you believe that air pollution can affect pregnancy outcomes even when other factors (like nutrition, smoking, or maternal weight) are controlled?
- ☐ Yes ☐ No ☐ No Idea
32. What pregnancy or birth complications do you think can be caused by exposure to air pollution? (Select all that apply)
- ☐ Premature birth (Baby born early)
 - ☐ Low birth weight (Baby born smaller than normal)
 - ☐ Miscarriage (loss of baby during pregnancy)
 - ☐ Stillbirth (baby born dead)
 - ☐ None of the above
 - ☐ Not sure

33. Which of the following health problems in newborns do you think can be linked to air pollution exposure during pregnancy? (select as many possible)

- ☐ Congenital heart defects (heart defects)
- ☐ Attention deficit hyper active disorder (ADHD)
- ☐ Developmental delay (speech delay, delay in learning etc.)
- ☐ Neonatal jaundice
- ☐ autism spectrum disorder (ASD)
- ☐ Lung problems
- ☐ leukemia
- ☐ Weak immune system
- ☐ Not sure

34. Do you believe that exposure to high air pollution during pregnancy can increase the risk of complications for the mother, such as high blood pressure, gestational diabetes, or preeclampsia?

- ☐ Yes ☐ No ☐ No Idea

Section D: Impact on children's brain and development

35. Do you know that a child's brain grows the most in the first five years, and that air pollution during this time (even before birth) can harm brain development?

- ☐ Yes ☐ No ☐ No Idea

36. Do you think children living in highly polluted areas are more likely to face delays in cognitive function (learning, thinking, attention and IQ level)

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly disagree

37. Do you think early exposure to air pollution can affect a child's ability to manage emotions?

- ☐ Yes ☐ No ☐ No Idea

38. Do you believe air pollution exposure before and after birth can result in stunted growth in children?

- ☐ Yes ☐ No ☐ No Idea

39. In your opinion, can long-term exposure to polluted air lead to mental health issues later in life?
- ☐ Strongly agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly disagree
40. In your opinion, which of the following mental health challenges can people experience in adulthood due to long-term exposure to air pollution (You may select more than one)
- ☐ Anxiety
 - ☐ Depression
 - ☐ Suicidal thoughts
 - ☐ Schizophrenia
 - ☐ Memory problem
 - ☐ Not sure
 - ☐ No mental health risks
41. Do you think health problems caused by air pollution can affect children's learning, such as missing school frequently due to illness?
- ☐ Strongly agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly disagree
42. Do you agree that early-life illnesses and premature death caused by air pollution can lead to long-term poor health, reduce a person's productivity, and result in a loss for the country's development?
- ☐ Strongly agree
 - ☐ Agree
 - ☐ Disagree
 - ☐ Strongly disagree
 - ☐ Not sure
43. How concerned are you about air pollution affecting your child's health?
- ☐ Not concerned
 - ☐ slightly concerned
 - ☐ very concerned

44. Would you be willing to participate in an awareness program on air pollution and ways to protect children from its harmful effects?

- ☐ Yes, definitely
- ☐ Maybe, if it's convenient
- ☐ Not interested
- ☐ Not sure

Appendix: 2: Research Tool: Survey Questionnaire (Bangla)

০-৫ বছর বয়সী শিশুদের স্বাস্থ্য ও বিকাশের উপর বায়ু দূষণ এবং এর প্রভাব সম্পর্কে পিতামাতার ধারণা সম্পর্কিত জরিপ প্রশ্নাবলী

বিভাগ ক: জনসংখ্যা সংক্রান্ত তথ্য

১। অনুগ্রহ করে আপনার লিঙ্গ উল্লেখ করুন:

- ☐ পুরুষ ☐ মহিলা

২। আপনার বয়স:

- ☐ ১৮-২৫
- ☐ ২৬-৩৩
- ☐ ৩৪-৪১
- ☐ ৪২-৪৯
- ☐ ৫০ এবং তার বেশি

৩। অনুগ্রহ করে উল্লেখ করুন আপনি ঢাকা শহরের কোন এলাকায় থাকেন?

- ☐ গুলশান
- ☐ বনানী
- ☐ ধানমন্ডি
- ☐ উত্তরা
- ☐ মহাখালী
- ☐ মোহাম্মদপুর
- ☐ নিকেতন
- ☐ বসুন্ধরা
- ☐ বাড্ডা
- ☐ রামপুরা
- ☐ অন্যান্য _____ (অনুগ্রহ করে উল্লেখ করুন)

৪। অনুগ্রহ করে আপনার সর্বোচ্চ শিক্ষাগত যোগ্যতা উল্লেখ করুন

- ☐ এস.এস.সি

- ☐ এইচ.এস.সি
- ☐ সম্মান/স্নাতক ডিগ্রি
- ☐ স্নাতকোত্তর
- ☐ কোন আনুষ্ঠানিক শিক্ষা নেই

৫। অনুগ্রহ করে আপনার পেশা উল্লেখ করুন

- ☐ সরকারি কর্মী
- ☐ বেসরকারি খাতের কর্মী
- ☐ ব্যবসা
- ☐ ফ্রিল্যান্সার
- ☐ গৃহিণী
- ☐ বেকার

৬। অনুগ্রহ করে আপনার আনুমানিক পারিবারিক আয় উল্লেখ করুন

- ☐ ২৫,০০০ টাকা – ৩৯,৯৯৯ টাকা
- ☐ ৪০,০০০ টাকা – ৪৯,৯৯৯ টাকা
- ☐ ৫০,০০০ টাকা – ৫৯,৯৯৯ টাকা
- ☐ ৬০,০০০ টাকা – ৬৯,৯৯৯ টাকা
- ☐ ৭০,০০০ টাকা – ৭৯,৯৯৯ টাকা
- ☐ ৮০,০০০ টাকা – ৮৯,৯৯৯ টাকা
- ☐ ৯০,০০০ টাকা – ৯৯,৯৯৯ টাকা
- ☐ ১,০০,০০০ টাকার উপরে

৭। আপনার কি ৫ বছরের কম বয়সী কোন সন্তান আছে?

- ☐ হ্যাঁ
- ☐ না

৮। অনুগ্রহ করে আপনার সন্তানের লিঙ্গ উল্লেখ করুন

- ☐ পুরুষ
- ☐ মহিলা

৯। অনুগ্রহ করে আপনার সন্তানের বয়সসীমা উল্লেখ করুন

- ☐ ০-১ বছর
- ☐ ১-২ বছর
- ☐ ২-৩ বছর
- ☐ ৩-৪ বছর
- ☐ ৪-৫ বছর

ভাগ খ: বায়ু দূষণ সম্পর্কে জ্ঞান

১০। আপনি কি বায়ু দূষণের ধারণা সম্পর্কে সচেতন?

- ☐ হ্যাঁ
- ☐ না

১১। বায়ু দূষণ সম্পর্কে আপনার তথ্য বা সচেতনতার প্রধান উৎস কী?

- ☐ সংবাদপত্র
- ☐ টিভি/রেডিও
- ☐ সামাজিক যোগাযোগ মাধ্যম
- ☐ ইন্টারনেট
- ☐ ওয়েবসাইট
- ☐ স্কুল/কলেজ/বিশ্ববিদ্যালয়/কর্মক্ষেত্র
- ☐ প্রবন্ধ/শিক্ষাগত জার্নাল
- ☐ পরিবার/বন্ধুবান্ধব
- ☐ অন্যান্য _____ (দয়া করে উল্লেখ করুন)

১২। আপনার এলাকায় বায়ু দূষণের প্রধান কারণ কী বলে আপনি মনে করেন?
(একাধিক উত্তর)

- ☐ যানবাহনের ধোঁয়া
- ☐ শিল্প নির্গমন/ ইটের ভাটা
- ☐ গৃহস্থালির রান্না
- ☐ বর্জ্য পোড়ানো
- ☐ নির্মাণ ধুলো/ অবকাঠামো উন্নয়ন
- ☐ জনসংখ্যা বৃদ্ধি
- ☐ সিগারেটের ধোঁয়া
- ☐ উপরের সবগুলো
- ☐ অন্যান্য _____ (দয়া করে উল্লেখ করুন)
- ☐ জানি না

১৩। আপনি কি মনে করেন বায়ু দূষণ জনস্বাস্থ্য এবং সুস্থতার জন্য একটি গুরুতর সমস্যা?

- ☐ একমত ☐ অসম্মতি ☐ নিশ্চিত নই

১৪। আপনার মতে বায়ু দূষণের ফলে কারা গুরুতরভাবে ক্ষতিগ্রস্ত?

- ☐ শিশু
- ☐ প্রাপ্তবয়স্ক
- ☐ বয়স্ক

১৫। আপনার বসবাসের এলাকার বায়ুর মান কেমন হবে?

- ☐ খুব ভালো
- ☐ ভালো
- ☐ মাঝারি
- ☐ খারাপ

☐ খুব খারাপ

১৬। আপনার এলাকার বায়ুর মানের বর্তমান অবনতি সম্পর্কে আপনার কেমন লাগবে?

☐ চিন্তা করবেন

☐ চিন্তা করবেন না

☐ আমার কোনও উদ্বেগ নেই

১৭। আপনার কি মনে হয় দূষণ কমাতে এবং এর প্রভাব থেকে মানুষকে রক্ষা করার জন্য বায়ু দূষণ সম্পর্কে মানুষের সচেতনতা বৃদ্ধি করা প্রয়োজন?

☐ দৃঢ়ভাবে একমত

☐ একমত

☐ নিরপেক্ষ

☐ অসম্মত

☐ দৃঢ়ভাবে অসম্মত

বিভাগ গ: শিশু স্বাস্থ্যের উপর প্রভাব

১৮। প্রাপ্তবয়স্কদের তুলনায় শিশুরা বায়ু দূষণের জন্য বেশি সংবেদনশীল?

☐ হ্যাঁ

☐ না

☐ নিশ্চিত নই

১৯। আপনার কি মনে হয় বায়ু দূষণ মাতৃগর্ভের শিশুদের মধ্যে মৃত্যুহার এবং দীর্ঘস্থায়ী স্বাস্থ্য সমস্যার কারণ হতে পারে?

☐ হ্যাঁ

☐ না

☐ নিশ্চিত নই

২০। আপনার কি মনে হয় বায়ু দূষণ শিশুদের শ্বাসযন্ত্রের স্বাস্থ্যের ক্ষতি করতে পারে যার ফলে তীব্র এবং দীর্ঘস্থায়ী উভয় ধরনের সমস্যা দেখা দিতে পারে?

☐ হ্যাঁ

☐ না

☐ নিশ্চিত নই

২১। বায়ু দূষণের কারণে শিশুদের মধ্যে কী ধরনের শ্বাসযন্ত্রের সমস্যা দেখা দিতে পারে বলে আপনি মনে করেন?

(আপনার যতগুলো মনে হয় ততগুলো নির্বাচন করুন)

☐ কাশি এবং গলা জ্বালা

☐ হাঁপানি

☐ নিউমোনিয়া

☐ ঘন ঘন ঠান্ডা লাগা বা সংক্রমণ

☐ ব্রঙ্কাইটিস

☐ কান এবং নাকের সংক্রমণ

- ☐ শ্বাসকষ্ট
- ☐ অ্যালার্জি
- ☐ অন্যান্য _____ (দয়া করে উল্লেখ করুন)
- ☐ জানি না

২২। আপনার কি মনে হয় (জীবনের প্রথম পাঁচ বছরে) বায়ু দূষণের প্রাথমিক সংস্পর্শে আসা শিশুর ফুসফুসের বিকাশকে প্রভাবিত করতে পারে?

- ☐ হ্যাঁ
- ☐ না
- ☐ নিশ্চিত নই

২৩। আপনার কি মনে হয় বায়ু দূষণের দীর্ঘমেয়াদী সংস্পর্শে আসা প্রাপ্তবয়স্কদের মধ্যে ফুসফুসের ক্যান্সার হতে পারে?

- ☐ হ্যাঁ
- ☐ না
- ☐ নিশ্চিত নই

২৪। বায়ু দূষণের কারণে সাম্প্রতিক সময়ে আপনার বাচ্চাদের মধ্যে কোন শ্বাসকষ্টের সমস্যা লক্ষ্য করেছেন?

- ☐ হ্যাঁ
- ☐ না

২৫। আপনার কি মনে হয় শৈশবকাল থেকেই দীর্ঘমেয়াদী বায়ু দূষণের সংস্পর্শে থাকার ফলে পরবর্তী জীবনে হৃদরোগের ঝুঁকি বেড়ে যায়?

- ☐ হ্যাঁ
- ☐ না
- ☐ কোন ধারণা নেই

২৬। দীর্ঘমেয়াদী বায়ু দূষণের সংস্পর্শে থাকার ফলে নিম্নলিখিত কোন হৃদরোগের সমস্যা হতে পারে বলে আপনার মনে হয়? (আপনার যতগুলো মনে হয় তা নির্বাচন করুন)

- ☐ উচ্চ রক্তচাপ
- ☐ হার্ট অ্যাটাক
- ☐ স্ট্রোক
- ☐ অনিয়মিত হৃদস্পন্দন
- ☐ ধমনী বন্ধ
- ☐ নিশ্চিত নই
- ☐ হৃদরোগের ঝুঁকি নেই

২৭। আপনার কি মনে হয় যে দীর্ঘমেয়াদী বায়ু দূষণের সংস্পর্শে আসার ফলে পরবর্তী জীবনে টাইপ ২ ডায়াবেটিস হওয়ার ঝুঁকি বেড়ে যেতে পারে?

- ☐ হ্যাঁ
- ☐ না
- ☐ কোন ধারণা নেই

২৮। বায়ু দূষণ সূর্যালোককে বাধা দিতে পারে এবং শিশুদের মধ্যে ভিটামিন ডি উৎপাদন কমাতে পারে যার ফলে ভিটামিন ডি এর ঘাটতি এবং রিকেটস হতে পারে। আপনি কি এই বক্তব্যের সাথে একমত?

- ☐ দৃঢ়ভাবে একমত
- ☐ একমত
- ☐ নিরপেক্ষ
- ☐ অসম্মত
- ☐ দৃঢ়ভাবে একমত

২৯। আপনি কি জানেন যে যানবাহনের নিগমন, বিশেষ করে ভারী যানবাহন থেকে নিগমন, বায়ু দূষণে উল্লেখযোগ্য অবদান রাখে এবং শিশুদের স্বাস্থ্যের উপর প্রভাব ফেলতে পারে?

- ☐ হ্যাঁ
- ☐ না
- ☐ কোন ধারণা নেই

৩০। আপনার কি মনে হয় যানবাহন সম্পর্কিত দূষণ শৈশবকালে স্থূলতার ঝুঁকি বাড়াতে পারে?

- ☐ হ্যাঁ
- ☐ না
- ☐ কোন ধারণা নেই

বিভাগ ঘ: গর্ভাবস্থা এবং নবজাতকের স্বাস্থ্যের উপর প্রভাব

৩১। আপনি কি বিশ্বাস করেন যে অন্যান্য কারণ (যেমন পুষ্টি, ধূমপান, বা মায়ের ওজন) নিয়ন্ত্রণ করা হলেও বায়ু দূষণ গর্ভাবস্থার ফলাফলকে প্রভাবিত করতে পারে?

- ☐ হ্যাঁ
- ☐ না
- ☐ কোন ধারণা নেই

৩২। বায়ু দূষণের সংস্পর্শে আসার ফলে কোন গর্ভাবস্থা বা জন্মগত জটিলতা দেখা দিতে পারে বলে আপনার মনে হয়? (প্রযোজ্য সমস্ত নির্বাচন করুন)

- ☐ অকাল জন্ম (শিশুর অকাল জন্ম)
- ☐ কম জন্ম ওজন (স্বাভাবিকের চেয়ে কম জন্ম)
- ☐ গর্ভপাত (গর্ভাবস্থায় শিশুর মৃত্যু)
- ☐ মৃত জন্ম (মৃত জন্মে শিশু)
- ☐ উপরের কোনটিই নয়
- ☐ নিশ্চিত নই

৩৩। নবজাতকের নিম্নলিখিত কোন স্বাস্থ্য সমস্যাগুলি গর্ভাবস্থায় বায়ু দূষণের সংস্পর্শের সাথে সম্পর্কিত বলে আপনি মনে করেন? (যতটা সম্ভব নির্বাচন করুন)

- ☐ জন্মগত হৃদরোগ (হৃদরোগ)

- ☐ মনোযোগ ঘাটতি হাইপার অ্যাক্টিভ ডিসঅর্ডার (ADHD)
- ☐ বিকাশগত বিলম্ব (বক্তৃতা বিলম্ব, শেখার বিলম্ব ইত্যাদি)
- ☐ নবজাতক জন্ডিস
- ☐ অটিজম স্পেকট্রাম ডিসঅর্ডার (ASD)
- ☐ ফুসফুসের সমস্যা
- ☐ লিউকেমিয়া
- ☐ দুর্বল রোগ প্রতিরোধ ক্ষমতা
- ☐ নিশ্চিত নই

৩৪। আপনি কি বিশ্বাস করেন যে গর্ভাবস্থায় উচ্চ বায়ু দূষণের সংস্পর্শে মায়ের জন্য উচ্চ রক্তচাপ, গর্ভকালীন ডায়াবেটিস বা প্রিক্যাম্পসিয়ার মতো জটিলতার ঝুঁকি বাড়াতে পারে?

- ☐ হ্যাঁ
- ☐ না
- ☐ কোন ধারণা নেই

বিভাগ গ: শিশুদের মস্তিষ্ক এবং বিকাশের উপর প্রভাব

৩৫। আপনি কি জানেন যে একটি শিশুর মস্তিষ্ক প্রথম পাঁচ বছরে সবচেয়ে বেশি বৃদ্ধি পায় এবং এই সময়কালে (এমনকি জন্মের আগেও) বায়ু দূষণ মস্তিষ্কের বিকাশের ক্ষতি করতে পারে?

- ☐ হ্যাঁ
- ☐ না
- ☐ কোন ধারণা নেই

৩৬। আপনি কি মনে করেন যে অত্যন্ত দূষিত এলাকায় বসবাসকারী শিশুদের জ্ঞানীয় কার্যকারিতা (শেখা, চিন্তাভাবনা, মনোযোগ এবং আইকিউ স্তর) বিলম্বের সম্মুখীন হওয়ার সম্ভাবনা বেশি থাকে

- ☐ দৃঢ়ভাবে একমত
- ☐ একমত
- ☐ নিরপেক্ষ
- ☐ অসম্মত
- ☐ দৃঢ়ভাবে একমত

৩৭। আপনি কি মনে করেন বায়ু দূষণের প্রাথমিক সংস্পর্শে আসা শিশুর আবেগ নিয়ন্ত্রণ করার ক্ষমতাকে প্রভাবিত করতে পারে?

- ☐ হ্যাঁ
- ☐ না
- ☐ কোন ধারণা নেই

৩৮। আপনি কি বিশ্বাস করেন যে জন্মের আগে এবং পরে বায়ু দূষণের সংস্পর্শে শিশুদের বুদ্ধি ব্যাহত হতে পারে?

- ☐ হ্যাঁ
- ☐ না
- ☐ কোন ধারণা নেই

৩৯। আপনার মতে, দূষিত বায়ুর দীর্ঘমেয়াদী সংস্পর্শে থাকার ফলে কি পরবর্তী জীবনে মানসিক স্বাস্থ্য সমস্যা দেখা দিতে পারে?

- ☐ দৃঢ়ভাবে একমত
- ☐ একমত
- ☐ নিরপেক্ষ
- ☐ অসম্মত
- ☐ দৃঢ়ভাবে একমত

৪০। আপনার মতে, দীর্ঘমেয়াদী বায়ু দূষণের সংস্পর্শে আসার কারণে প্রাপ্তবয়স্কদের মধ্যে নিম্নলিখিত মানসিক স্বাস্থ্য চ্যালেঞ্জগুলির মধ্যে কোনটি মানুষ অনুভব করতে পারে (আপনি একাধিক নির্বাচন করতে পারেন)

- ☐ উদ্বেগ
- ☐ বিষণ্ণতা
- ☐ আত্মহত্যার চিন্তাভাবনা
- ☐ সিজোফ্রেনিয়া
- ☐ স্মৃতিশক্তির সমস্যা
- ☐ নিশ্চিত নই
- ☐ মানসিক স্বাস্থ্য চ্যালেঞ্জ এর ঝুঁকি নেই

৪১। আপনার কি মনে হয় বায়ু দূষণের কারণে সৃষ্ট স্বাস্থ্য সমস্যা শিশুদের শেখার উপর প্রভাব ফেলতে পারে, যেমন অসুস্থতার কারণে ঘন ঘন স্কুল অনুপস্থিতি?

- ☐ দৃঢ়ভাবে একমত
- ☐ একমত
- ☐ নিরপেক্ষ
- ☐ একমত নই
- ☐ দৃঢ়ভাবে একমত নই

৪২। আপনি কি একমত যে বায়ু দূষণের কারণে শৈশবে অসুস্থতা এবং অকাল মৃত্যু দীর্ঘমেয়াদী খারাপ স্বাস্থ্যের দিকে পরিচালিত করতে পারে, একজন ব্যক্তির উৎপাদনশীলতা হ্রাস করতে পারে এবং দেশের উন্নয়নের জন্য ক্ষতিকর হতে পারে?

- ☐ দৃঢ়ভাবে একমত
- ☐ একমত
- ☐ নিরপেক্ষ
- ☐ একমত নই
- ☐ দৃঢ়ভাবে একমত নই

৪৩।আপনার সন্তানের স্বাস্থ্যের উপর বায়ু দূষণের প্রভাব সম্পর্কে আপনি কতটা উদ্বিগ্ন?

☐ উদ্বিগ্ন নই ☐ সামান্য উদ্বিগ্ন ☐ খুব উদ্বিগ্ন

৪৪।আপনি কি বায়ু দূষণ এবং এর ক্ষতিকারক প্রভাব থেকে শিশুদের রক্ষা করার উপায় সম্পর্কে একটি সচেতনতামূলক কর্মসূচিতে অংশগ্রহণ করতে ইচ্ছুক হবেন?

☐ হ্যাঁ, অবশ্যই
☐ হয়তো, যদি এটি সুবিধাজনক হয়
☐ আগ্রহী নই
☐ নিশ্চিত নই

Appendix :3: Consent Form (English)

Title of the Study:

Parents Perception of Air pollution and the Impact of Air pollution on the Health and Development of Children aged 0-5 years.

Researcher: Tashnuva Rashid

Purpose of the Study:

This study is a requirement for the completion of my Master's degree at the BRAC University's Institute of Educational Development. The aim of the study is to gain insight into parents' perceptions of air pollution and its effects on the health and development of children under 5 years of age.

Expectation from you:

If you agree to participate in the study, you will be asked to complete a survey questionnaire. This questionnaire includes questions about your demographic information, as well as your knowledge and perceptions of air pollution and its impact on the health and development of children under 5 years of age.

Risks:

Participation in this survey poses no threat or risk to you or your child, either directly or indirectly.

Benefits:

Your participation will help raise awareness among parents of young children about the effects of air pollution. The findings may also support the development of effective strategies, interventions, and policies for relevant stakeholders.

Privacy, anonymity and confidentiality:

All information collected will be used solely for research purposes and will be kept strictly confidential. Data will be stored securely and handled anonymously. If you have any questions or concerns regarding the study, please feel free to contact me.

Future use of information:

Some data from this study may be preserved for future use. However, strict measures will be taken to ensure that any information shared with other researchers fully protects the privacy and confidentiality of all participants.

Voluntary Participation:

Your participation in this study is entirely voluntary, and the decision to take part is yours alone. You are free to withdraw at any time without any questions or consequences. If you choose to withdraw before completing the survey, any data you have provided will be fully and permanently deleted.

Consent:

I have read and understood the information above and voluntarily agree to participate in this study.

Participant's signature: _____

Researcher's signature: _____

Date: _____

Date: _____

Thank you very much for your cooperation. If you have any questions, please feel free to contact me using the details below:

Email: tashnuva.rashid@gmail.com

Phone: 01314562370

Appendix: 4: Consent Form (Bangla)**সম্মতিপত্র****রিসার্চের টাইটেল:**

বায়ু দূষণ সম্পর্কে পিতামাতার ধারণা এবং ০-৫ বছর বয়সী শিশুদের স্বাস্থ্য ও বিকাশের উপর এর প্রভাব।

গবেষক: তশনুভা রশিদ

রিসার্চের উদ্দেশ্য:

এই গবেষণাটি ব্র্যাক বিশ্ববিদ্যালয়ের শিক্ষাগত উন্নয়ন ইনস্টিটিউটে আমার স্নাতকোত্তর ডিগ্রি সম্পন্ন করার জন্য একটি প্রয়োজনীয়তা। গবেষণার লক্ষ্য হল বায়ু দূষণ সম্পর্কে

পিতামাতার ধারণা এবং ৫ বছরের কম বয়সী শিশুদের স্বাস্থ্য ও বিকাশের উপর এর প্রভাব সম্পর্কে অন্তর্দৃষ্টি অর্জন করা।

আপনার কাছ থেকে প্রত্যাশা:

আপনি যদি গবেষণায় অংশগ্রহণ করতে সম্মত হন, তাহলে আপনাকে একটি জরিপ প্রশ্নপত্র পূরণ করতে বলা হবে। এই প্রশ্নপত্রে আপনার জনসংখ্যাতাত্ত্বিক তথ্য, সেইসাথে বায়ু দূষণ সম্পর্কে আপনার জ্ঞান এবং ধারণা এবং ৫ বছরের কম বয়সী শিশুদের স্বাস্থ্য ও বিকাশের উপর এর প্রভাব সম্পর্কে প্রশ্ন অন্তর্ভুক্ত রয়েছে।

ঝুঁকি:

এই জরিপে অংশগ্রহণ আপনার বা আপনার সন্তানের জন্য প্রত্যক্ষ বা পরোক্ষভাবে কোনও হুমকি বা ঝুঁকি তৈরি করে না।

সুবিধা:

আপনার অংশগ্রহণ ছোট বাচ্চাদের পিতামাতার মধ্যে বায়ু দূষণের প্রভাব সম্পর্কে সচেতনতা বৃদ্ধিতে সহায়তা করবে। এই ফলাফলগুলি প্রাসঙ্গিক অংশীদারদের জন্য কার্যকর কৌশল, হস্তক্ষেপ এবং নীতিমালা তৈরিতেও সহায়তা করতে পারে।

গোপনীয়তা, পরিচয় গোপন রাখা এবং গোপনীয়তা:

সংগৃহীত সমস্ত তথ্য শুধুমাত্র গবেষণার উদ্দেশ্যে ব্যবহার করা হবে এবং কঠোরভাবে গোপন রাখা হবে। তথ্য নিরাপদে সংরক্ষণ করা হবে এবং বেনামে পরিচালনা করা হবে। গবেষণা সম্পর্কে আপনার যদি কোনও প্রশ্ন বা উদ্বেগ থাকে, তাহলে অনুগ্রহ করে আমার সাথে যোগাযোগ করতে দ্বিধা করবেন না।

তথ্যের ভবিষ্যতের ব্যবহার:

এই গবেষণা থেকে কিছু তথ্য ভবিষ্যতে ব্যবহারের জন্য সংরক্ষণ করা যেতে পারে। তবে, অন্যান্য গবেষকদের সাথে ভাগ করা যেকোনো তথ্য যাতে সমস্ত অংশগ্রহণকারীদের গোপনীয়তা এবং গোপনীয়তা সম্পূর্ণরূপে সুরক্ষিত থাকে তা নিশ্চিত করার জন্য কঠোর ব্যবস্থা নেওয়া হবে।

স্বেচ্ছাসেবী অংশগ্রহণ:

এই গবেষণায় আপনার অংশগ্রহণ সম্পূর্ণ স্বেচ্ছাসেবী, এবং অংশগ্রহণের সিদ্ধান্ত আপনার একার। আপনি যেকোনো সময় কোনও প্রশ্ন বা পরিণতি ছাড়াই প্রত্যাহার করতে পারেন। যদি আপনি জরিপটি সম্পূর্ণ করার আগে প্রত্যাহার করতে চান, তাহলে আপনার দেওয়া যেকোনো তথ্য সম্পূর্ণ এবং স্থায়ীভাবে মুছে ফেলা হবে।

সম্মতি:

আমি উপরের তথ্য পড়েছি এবং বুঝতে পেরেছি এবং স্বেচ্ছায় এই গবেষণায় অংশগ্রহণ করতে সম্মত।

অংশগ্রহণকারীর স্বাক্ষর: _____ গবেষকের স্বাক্ষর: _____

তারিখ: _____ তারিখ: _____

আপনার সহযোগিতার জন্য অনেক ধন্যবাদ। যদি আপনার কোন প্রশ্ন থাকে, তাহলে
নীচের বিবরণ ব্যবহার করে আমার সাথে যোগাযোগ করতে দ্বিধা করবেন না:

ইমেল: tashnuva.rashid@gmail.com

ফোন: 01314562370