

**ASSESSING THE FREQUENCY AND RISK FACTORS
OF ASTHMA IN SCHOOL CHILDREN OF ISLAMABAD,
PAKISTAN**

**PROGRAM
BS PUBLIC HEALTH**



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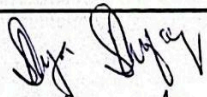
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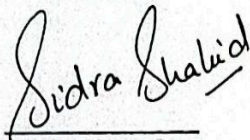
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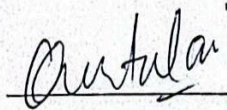
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ABSTRACT

Asthma is one of the common chronic respiratory diseases in children worldwide which is more prevalent with urbanization in many low or middle-income countries including Pakistan. In the times of rapid urbanisation and more exposure to environmental pollutants, there is dearth of data regarding region-specific prevalence of asthma, risk factors and possible associated factors in school going children. To estimate the prevalence of asthma among 5-17-year-old school going children in Islamabad, and its associated environmental, genetic and socio-demographic risk factor. A cross-sectional study was conducted on 333 children in the schools of Islamabad who were assessed for asthma. Data was obtained through a structured questionnaire adopted from ISAAC protocol. Asthma was characterized by wheezing and doctor diagnosed disease. Descriptive statistics, chi-square tests and correlation were conducted in SPSS. The study reveals a noticeable high prevalence of lifetime wheeze, doctor's diagnosis of asthma among patients. Significant multivariate predictors of asthma included household smoking, maternal smoking during pregnancy, indoor dampness/mold, excess dust, and living near traffic/industry, exposure to seasonal pollen/dust, having a parental history of asthma and parental consanguinity. This study showed high association of demographic, environmental and genetic factors with asthma. The findings call for immediate public health interventions focusing on smoke-free homes, improved indoor air quality, pollution control and enhanced awareness and management of asthma in urban Islamabad, Pakistan.

Keywords: childhood asthma, prevalence, risk factors environmental exposure, genetic

TABLE OF CONTENTS

CHAPTER ONE	viii
INTRODUCTION	viii
1.1 Research Gap	x
1.2 Problem statement	x
1.3 Objectives	xi
1.4 Research questions	xi
1.5 Significance	xi
CHAPTER II	xiv
LITERATURE REVIEW	xiv
2.1 Asthma in children	xiv
2.2 Unravelling the multifactorial Etiology of childhood asthma	xv
2.2.1 Environmental factor	xv
2.2.2 Outdoor environmental factors	xvi
2.2.3 Indoor environmental factors	xvii
2.2.4 Lifestyle factors	xx
2.2.5 Genetic factors	xx
2.2.6 Prenatal, perinatal and Postnatal Factors	xxi
2.2.7 consanguineous marriages	xxii
2.3 Increasing prevalence: a global perspective	xxiii
2.3.1 Morbidity and mortality	xxiv
2.3.2 Global asthma burden	xxv
2.4 Prevalence of asthma in Pakistan	xxvi
CHAPTER THREE	xxviii
RESEARCH METHODOLOGY	xxviii
3.1 Research design	xxviii
3.2 Sampling techniques	xxix
3.3 Sampling and data collection	xxix
3.4 Universe	xxix
3.5 Population frame	xxix
3.6 Sample size calculation	xxix

3.7 Data analysis technique.....	xxix
3.8 inclusion and exclusion criteria.....	xxx
3.9 Ethical considerations.....	xxx
CHAPTER FOUR.....	xxx
DATA ANALYSIS.....	xxx
4.1 DESCRIPTIVE ANALYSIS.....	xxxii
4.2 CORRELATION ANALYSIS.....	xlvi
CHAPTER FIVE.....	l
DISCUSSION AND CONCLUSION.....	l
DISCUSSION.....	l
5.1.1 Research limitation.....	lii
5.1.2 Recommendations for future.....	liii
CONCLUSION.....	liii
REFERENCES.....	lv

LIST OF TABLES

Table 1. frequency distribution of sociodemographic factors.....	xxxii
Table 2. family member, sibling, rooms and sleeping arrangements in household.	xxxv
Table 3. Prevalence of asthma in school children of Islamabad.....	xxxvi
Table 4. Environmental factors.....	xl
Table 5. Genetic factors.....	xliii
table 6. Correlation of asthma with socio-demographic factors.....	xliv
Table 7. Correlation of asthma with environmental factors.....	xlvi
Table 8. Correlation of asthma with genetic factors.....	xlix

CHAPTER ONE

INTRODUCTION

One of the prevalent chronic respiratory diseases affecting children worldwide is asthma. It is characterized by recurrent episodes of coughing, chest tightness, wheezing and dyspnoea that vary in frequency and intensity. According to estimate 10% children worldwide suffer from asthma with geographical variations (Zhou & Tang.,2025). In developing countries like Pakistan, prevalence of asthma is rising because of urbanisation, pollution and lifestyle changes (Fasola et al., 2022).

According to Alfonso et al.(2019) the first rate of urbanization in Islamabad the capital of Pakistan, has led to a high level of exposure to environmental pollutants including industrial effluents and vehicle emissions. These, together with lifetime notification and hereditary factors have made youngsters more susceptible to asthma. According to studies, the prevalence of asthma in school age children in Pakistan's metropolitan centres ranges from 14% to 13% with significant differences based on environmental factors and socioeconomic class (Fasola et al., 2022).Children with asthma may experience unpleasant everyday symptoms that interfere with play, education and sleep. Some children who have uncontrolled asthma experience possibly deadly asthma episodes(Wang et al., 2005). Although childhood asthma is not different condition from adult asthma, it is made more difficult by problems that are specific to children. The illness is a leading cause of hospital stays, ER visits and absence from school(Hsu et al., 2016). Unfortunately, there is no cure for childhood asthma and symptoms might last under the adulthood but with the right care damage can be prevented.The symptoms of asthma vary from child to child. Additionally, a kid's symptoms may vary from one episode to the next. Asthma can strike up to 10-15% of boys and 7-10% of girls are some points throughout their childhood (Khan et al., 2022).

According toWHO et al., (2024)although asthma can strike at any age, it usually first manifests in childhood when a child's immune system is developing and any number of factors can affect how the child's lungs develop or how their body fights off infections. Branum et al., (2008)says that children's asthma has a complicated aetiology that includes lifestyle, environmental, and genetic variables.

One significant component is genetic predisposition, such as a family history of asthma or other allergy illnesses. Fasola et al., (2022) also explain Important drivers also include exposure to environmental factors such air pollution, passive smoking, seasonal patterns and allergens like mould, dust mites, strong emotions expression, chemical irritant and drugs, animal with fur, occupational irritant and pet dander. the risk is also increased by lifestyle factors like obesity, physical inactivity, and eating habits (Alfonso et al., 2019)

Ferrante & La Grutta et al.,(2018)emphasized that one of the major clinical concerns in the globe is the epidemiology of childhood asthma, which places a significant cost on both the family and society. According to Khan et al., (2024) It is responsible for a significant number of missed school days and deprives kids of socialisation and academic progress. Due to the high cost of care, children's urgent trips to doctors' offices and hospitals strain healthcare resources. Every year, more than 20,000 children with asthma are admitted to hospitals, with most of these cases occurring in the autumn. Children are more vulnerable to viral infections when they go back to school, which can exacerbate symptoms of asthma. Asthma symptoms, which are common in youngsters and easily transmitted in a school environment, can be effectively triggered by respiratory infections (Wu et al., 2020).

There is limited research on the prevalence of asthma and its associated risk factors among schoolchildren in Islamabad. Most of past research has either examined individual risk factors or more generalized populations, and we have very little information related to the specific problems faced by school children in this context(Waqar et al., 2010). By conducting a detailed exploration of the prevalence and risk factors related to asthma among schoolchildren in Islamabad, the current study seeks to address these significant gaps(Samoo and Ehsan.,2021). Even though science is improving, an increasing number of children and adults are being diagnosed with asthma. This may partly be due to our general understanding of the potential triggers of asthma and our existing disease management capabilities(Asher et al., 2021). A plethora of research studies indicate asthma prevalence continues to escalate worldwide, and the etiology of asthma remains clearly unknown (Zhou & Tang, 2025).

This study aimed to explore how different elements relate to childhood asthma. Despite progress in understanding and managing asthma, detailed research into local risk factors remains necessary. Because such information is limited, designing effective child-focused strategies across regions becomes difficult (Khan et al., 2022). In parts of Pakistan, evidence on paediatric asthma and associated risks is limited. Therefore, this work sought to identify common triggers among school-aged kids in Islamabad (Majeed et al., 2008). Finding risk factors helps apply prevention strategies while managing childhood asthma effectively. Kids whose asthma is managed properly show improved health, reduced emergency room trips, lower hospital admission rates, yet fewer check-ups (Sultana et al., 2022).

The results from this study could influence how health policies are shaped or updated. Because it highlights key risks, prevention plans may become more precise or effective. In addition, insights into how these factors interact might improve treatment approaches across different regions. Most importantly, knowledge about childhood asthma could grow, especially within low-resource areas such as Pakistan. Furthermore, it has helped in the understanding of paediatric asthma worldwide, particularly in underdeveloped countries like Pakistan.

1.1 Research Gap

Many studies have been conducted worldwide on asthma, however few of them concentrate on Pakistan. Even though asthma is a leading cause of morbidity in children worldwide, there is still a dearth of region-specific data, especially when it comes to the epidemiological patterns and risk factors that contribute to asthma in Islamabad. The specific environmental, genetic, and sociodemographic risk factors that lead to asthma in children in Islamabad need to be addressed. The dynamics of these elements and their relative importance were investigated in research.

1.2 Problem Statement

Airborne biological particles are responsible for massive health problems in hypersensitive children, particularly in Islamabad. However, data on asthma in school children is limited in this region. This study investigated the frequency of asthma and

environmental, genetic and socio-demographic risk factors relating to asthma in school children.

1.3 Objectives

- To determine the prevalence of asthma among school-aged children in Islamabad.
- To identify and analyse the environmental, genetic, and socio-demographic factors associated with asthma occurrence in children.

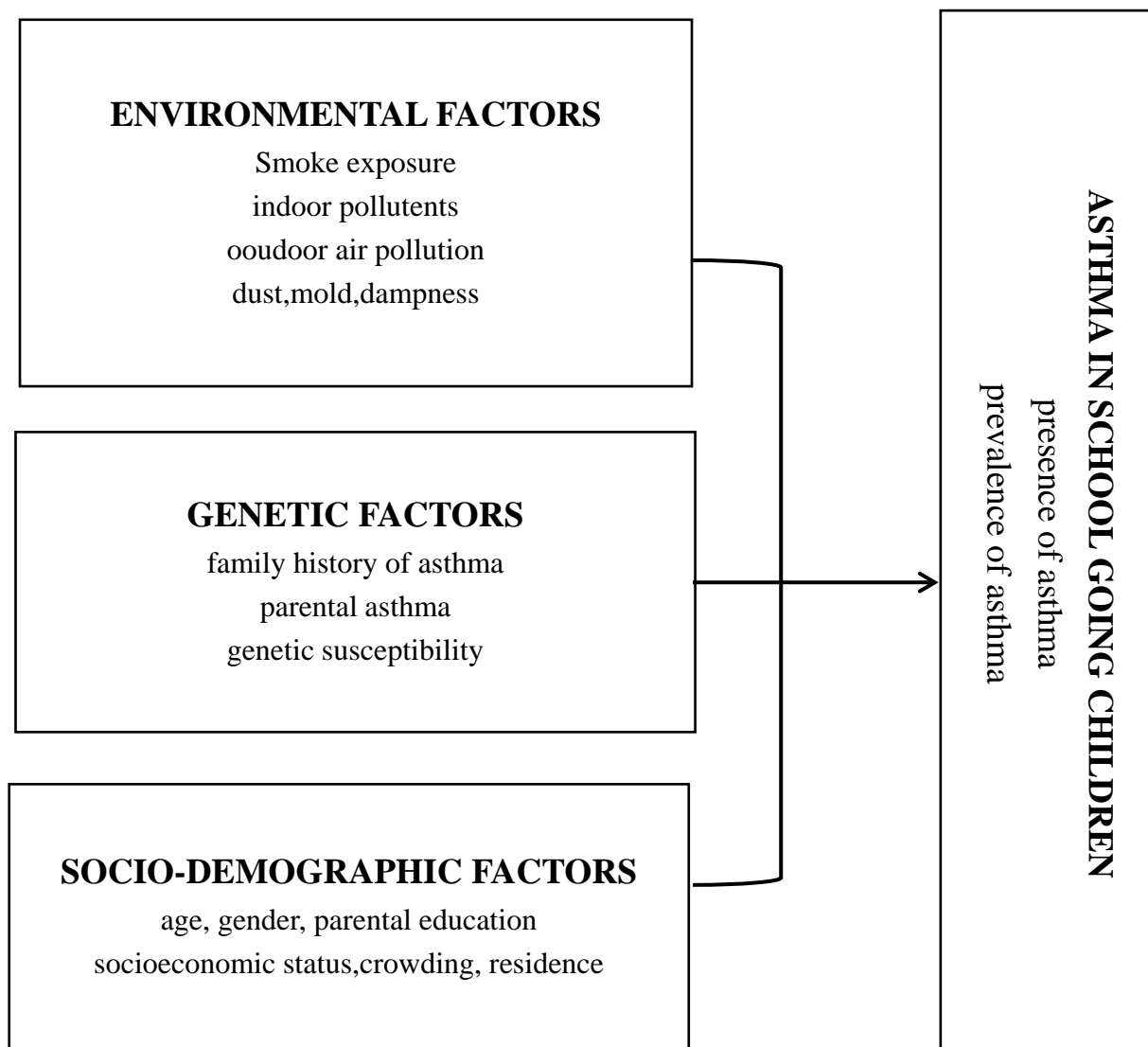
1.4 Research questions

- How does the prevalence of asthma vary among school children by age, gender, and season?
- Up to what extent the risk factors environmental, genetic associated with asthma among children in Islamabad?

1.5 Significance

This study assesses the relationship between several factors and the prevalence of asthma among schoolchildren in Islamabad to add to the body of existing information. The findings of this study contribute meaningful, context-specific evidence to the existing body of literature, which is essential for understanding how local environmental exposures, family history, indoor and outdoor pollutants, and demographic characteristics collectively influence asthma among Pakistani schoolchildren. Such information is vital, given that asthma patterns can vary significantly depending on regional climate, pollution levels, socioeconomic background, and lifestyle factors. This study fills the gaps and determines the prevalence of asthma risk factors affecting children attending private schools in Islamabad by incorporating local, evidence-based data. Policymakers, healthcare professionals, and educational institutions find the research useful in assessing asthma risks and directing management and prevention initiatives.

CONCEPTUAL FEMEWORK



CHAPTER TWO

LITERATURE REVIEW

2.1 Asthma in children

Asthma is a prevalent chronic inflammatory respiratory condition affecting millions of people worldwide and presents substantial challenges in both diagnosis and management (Asher et al., 2021). Prior researcher Hsu et al., (2016) says that respiratory condition is characterized by inflammation of the airways, causing intermittent airflow obstruction and bronchial hyper responsiveness. asthma is a chronic inflammatory respiratory condition characterized by hallmark symptoms of intermittent dyspnoea, cough, and wheezing. However, due to the nonspecific nature of these symptoms, distinguishing asthma from other respiratory illnesses can sometimes be challenging (WHO, 2024). A complex disorder, asthma is impacted by several lifestyles, environmental, and hereditary variables. Although a child's predisposition to asthma may be influenced by genetics, environmental variables like exposure to allergens, pollution, and respiratory infections frequently play a significant effect (Z. Iqbal et al., 2022). According to Enilari et al., (2019) over 262 million people worldwide suffered from asthma in 2019, making it one of the main causes of chronic illness in children. Over the past 40 years, childhood asthma's morbidity and mortality rates have dramatically increased worldwide. Emphasized by Zheng et al., (2025) that said although childhood asthma is widespread, it often goes undetected or poorly managed. Symptoms differ greatly across regions; in certain areas, cases are up to 13 times higher compared to others. High-income countries allocate just 1–2% of healthcare funds to this illness, suggesting limited financial burden. Established in 1989, GINA aims to lessen global asthma effects, encourage better management, while raising recognition of its rising rates (Taherian et al., 2024).

The onset of asthma, usually seen in children, depends on both hereditary traits and surroundings linked to allergic conditions like skin rashes or seasonal allergies. Scientists aim to build tools that forecast which patients will have ongoing

issues past teenage years (Goldin et al., 2024). Even with progress in spotting genes, outside influences, and warning signs, doctors still lack clear methods to lower chances of long-term asthma lasting into later life stages (Izadi et al., 2021). This review explains how common the condition is, what happens inside the body, ways to evaluate it, when to start medicine, also how to track symptoms specifically for older teens and grown-ups (Campbell et al., 2022).

2.2 Unravelling the multifactorial Etiology of childhood asthma

Scientists struggle to sort out how much genes versus surroundings affect kids' asthma, since both play a role. At the same time, they aim to pinpoint areas where prevention might work.

2.2.1 Environmental factor

Climate and environmental shifts pose serious health risks today, as noted by EPA et al. (2023) these include rising temperatures worldwide, shifting rain patterns, while extreme weather happens more often. Studies show climate change worsens asthma, particularly in kids (Hu et al., 2022). Poorer air plus more intense weather disrupts breathing, raising both cases and seriousness of asthma. Still, these health effects aren't spread evenly - location and timing play key roles (Poole et al., 2019).

It is pointed out by Yaqoob et al. (2025) that surroundings strongly affect when asthma starts or gets worse in kids. Contact with outdoor and indoor triggers like fumes from cars, cigarette smoke, dust mites, pets, or cleaning products can raise chances of developing asthma or flare-ups (Bowatte et al., 2014). Kids in cities tend to face more breathing issues because they're often near polluted air, vehicle exhaust, and toxic elements nearby. According to Syed et al., (2023), ongoing contact with pollutants, airborne irritants, lung infections, or secondhand smoke also adds risk, effects differ based on how sensitive a child is, along with when exposure happens, how long it lasts, and how strong it is. According to D'Amato et al., (2015) allergy triggers, particularly from house-based sources such as dust mites or animal skin flakes, are often tied to asthma onset especially among those highly sensitive. Ferrante and La Grutta (2018) says that the hygiene-related theory has sparked debate and further research on how gut and respiratory microbes influence asthma's development.

According to Breysse et al., (2010) there is a link between breathing dirty air like tiny particles or ozone and more asthma cases or worse symptoms. Poor air quality harms lung health, often tied to city growth and factories. Figuring out exact causes is hard when many pollutants mix together; pinpointing which ones hurt developing lungs most remains difficult (Yang et al., 2021). Respiratory infections especially viral ones during infancy affect asthma development. To grasp this link fully, research must explore the specific viruses involved as well as how they trigger inflammation or change airway structure (D'Amato et al., 2015). Several studies show that kids are more likely to develop asthma if they're exposed to cigarette smoke while in the womb or right after birth - so efforts should focus on reducing smoking rates (Bellou et al., 2022).

2.2.2 Outdoor environmental factors

Outdoor environmental exposure plays a critical role in development and progression of asthma in school going children. A recent Olsson et al., (2021) study found that annually nearly 2 million children worldwide develop asthma due to exposure to nitrogen dioxide (NO₂), a traffic-related air pollutant. Transportation is a key driver of this pollution. Trucks and buses make up less than 10% of the vehicles on U.S. roads, but they are responsible for half of the transportation sector's nitrogen oxide emissions. In some urban areas, 1 in 5 new childhood asthma cases are due to exposure to nitrogen dioxide; in particular, neighbourhood's, this risk can be twice as high (Guarnieri et al., 2014). High exposure to No₂ especially near busy roads and schools, can directly irritate the bronchial lining, increase airway inflammation, and enhance the sensitivity of the airways to allergens. Long-term exposure to No₂, particularly during the first year of life and at school, has been repeatedly associated with an increased risk of developing asthma (McConnell et al., 2010).

Living in homes situated near major industries or within heavily urbanized areas (big cities) significantly increases the risk of both developing and exacerbating asthma in children. These locations expose children to persistently high levels of various air pollutants, often exceeding the burden posed by traffic alone (Glinianaia et al., 2004). A major industrial pollutant, So₂ is a highly soluble and corrosive gas that can penetrate and irritate the bronchial airways, leading to inflammation and increased airway hyper responsiveness in susceptible children (Hwang et al., 2020). Urban

environments, with their high No. 2 and VOC emissions, are prone to creating high concentrations of ground-level Ozone during hot, sunny periods. O₃ is a powerful oxidant that triggers acute asthma symptoms and reduces lung function (Guarnieri & Balmes et al., 2014).

Seasonal allergies according to Linneberg et al., (2002) commonly known as allergic rhinitis or hay fever, are strongly and frequently associated with asthma in children. This link is so pronounced that the two conditions are often referred to as "one airway disease," where inflammation in the upper respiratory tract (allergic rhinitis) predisposes the lower respiratory tract to inflammation and hyperresponsiveness (Hauptman & Phipatanakul, 2015). Both allergic rhinitis and asthma involve a Type 2 helper T-cell inflammatory response when a child is exposed to a seasonal allergen like ragweed pollen, the body produces Immunoglobulin antibodies (Compalati et al., 2010). The subsequent binding of the allergen to mast cells triggers the release of inflammatory mediators like histamine and leukotrienes throughout the respiratory tract, while in the nose this causes sneezing and congestion, in the bronchi, it causes bronchoconstriction, and mucus production the defining features of an asthma attack (Zhang et al., 2014). Child with active allergic rhinitis requires a much smaller exposure to a non-allergic trigger like cold air or exercise to provoke an asthma attack compared to when their allergies are controlled (Rha & Choi, 2007).

2.2.3 Indoor environmental factors

Indoor environments, including homes and schools, are critical settings where children encounter numerous factors that can trigger or exacerbate asthma symptoms (Hauptman & Phipatanakul, 2015). Given that children spend a significant portion of their time indoors, exposure to indoor allergens and irritants is a primary driver of asthma morbidity (Breysse et al., 2010). According to Conroy et al., (2025) younger children may be more vulnerable to air pollution and pollen than adults because their lungs are still developing, they also breathe at a faster rate, increasing their exposure to air pollutants that can damage their lungs and may also be exposed to higher levels of pollution if they live in cities, near major highways or busy streets. Indoor pollution from cigarette smoke, burning wood, dust, mold, scented candles, or even cleaning

chemicals, can be irritants that trigger asthma attacks, especially for children who spend much of their time indoors(Franck et al., 2024).

Emphasized by Strachan & Cook et al., (1998) that parental smoking has an important impact on asthma and wheezing illnesses in infants and children, in utero exposure is associated with impaired lung growth and wheezing illnesses, particularly in preschool children. Exposure to environmental tobacco smoke is associated with increased wheezing illnesses and increased symptoms in asthmatics(Burke et al., 2012). There are no consistent data to confirm an effect of in utero or postnatal cigarette smoke exposure on the prevalence of asthma but there is evidence of increased severity of symptoms(Pattenden et al., 2006). The detrimental effects of parental smoking on lung growth will have an impact on respiratory health throughout life (Landau et al., 2001). The effect of parental smoking was assessed in 94 consecutively observed children, aged 7 to 17 years, who had a history of asthmatic wheezing. The 24 children whose mothers smoked, when they were compared with children whose mothers did not smoke, had 47% more symptoms(Toppila-Salmi et al., 2020).There was a highly significant correlation between the results of the tests and the number of cigarettes the mother smoked while she was in the house. The differences between the children of smoking and non-smoking mothers were greater in older than in younger subjects. Parental smoking is hazardous to all children, especially those who have asthma. Passive smoke exposure can cause an increase in asthma symptoms, emergency department visits, and hospital admissions(Beeber et al., 1996).

The use of unvented appliances or smoke-producing fuels (e.g., biomass, gas stoves) for cooking and heating introduces indoor pollutants like nitrogen dioxide and particulate matter, which are associated with increased asthma risk and exacerbations (Aljefri et al., 2024).Indoor exposure to emissions from cooking on gas stoves can worsen asthma symptoms, cause wheezing, and result in reduced lung function in children, particularly in the absence of ventilation and for children living with asthma or allergies (Padhi &Padhy, 2008). Wood-burning stoves used for heating create sharp increases in indoor levels of particle pollution. Emissions from wood smoke can cause coughing, wheezing, asthma attacks, heart attacks, lung cancer, and premature death, among other health effects. In fact, indoor wood burning is responsible for up to 90%

of local particulate matter pollution in smaller and rural communities (Naqvi et al., 2024). Using fuel-burning appliances at home also impacts the environment. The report showed that residential and commercial emissions made up 13% of total U.S. global warming emissions in 2020. Petroleum-based fuels, including natural gas, propane, fuel oil and kerosene are the primary driver of these emissions.

Several earlier studies have shown the presence of more dust and allergens in carpets compared with non-carpeted floors. At the same time, adverse effects of carpeted floors on perceived indoor air quality as well as worsening of symptoms in individuals with asthma and allergies were reported (Becher et al., 2018). Carpets and rugs may trap pollutants and allergens like dust mites, pet dander, cockroach allergens, particle pollution, lead, mold spores, pesticides, dirt and dust. Toxic gases in the air can stick to small particles that settle into carpets (Simpson et al., 1998). These pollutants may become airborne during renovations, vacuuming or even walking on the carpet. Certain carpet types, including shag or other high-pile varieties, as well as carpets older than 10 years, typically have higher levels of pollutants and allergens (Zock et al., 1994). If a large area is covered in carpet, it may be very difficult to remove indoor air pollutants and allergens. Children are more likely to be exposed to pollution in carpets and rugs. They spend time playing on the floor and place their hands in their mouths. Chemicals used in some new carpets, carpet pads and the adhesives used to install them can harm your health. Some of these products are made with VOCs which emit odors and chemicals emissions. High concentrations of HDM allergen in mattresses and pillows are consistently linked to allergic sensitization, increased bronchial hyper responsiveness, and subsequent asthma symptoms in children (Hauptman & Phipatanakul, 2015). These microscopic organisms thrive in the warm, humid microclimate created by sleeping bodies and feed on shed human skin scales (Aljefri et al., 2024). Heavy fabrics used in curtains and drapes readily trap pollen carried in from outside, pet dander, and dust, acting as secondary sources of exposure within the child's bedroom or classroom. When disturbed (e.g., opening or closing them), these allergens are released into the breathing zone (Sharma & Sood, 2014).

House dust mites (HDM) are one of the most significant and well-studied indoor environmental factors associated with asthma in children. They are

microscopic arachnids found primarily in bedding, upholstered furniture, and carpets, thriving in warm, humid environments (Aljefri et al., 2024). Dust mites are microscopic, insect-like pests that commonly live in house dust. They feed on flakes of dead skin, or dander, that are shed by people and pets. These tiny creatures are a big source of allergens and can worsen allergies and asthma (Huss et al., 2001). Dust mites can live in mattresses, bedding, upholstered furniture, carpets, and curtains in your home. Cockroaches are another source of indoor allergens. Researchers have found a link between the presence of cockroaches and an increase in the severity of asthma symptoms. These pests are most frequently found in urban areas and older dwellings (Baxi & Phipatanakul et al., 2010).

2.2.4 Lifestyle factors

According to Hallit et al., (2018) asthma is the most common childhood illness and disproportionately affects low-income, minority children who live in urban areas. A range of risk factors are associated with asthma morbidity and mortality, such as treatment non-adherence, exposure to environmental triggers, low-income households, exposure to chronic stress, child psychological problems, parental stress, family functioning, obesity, physical inactivity, and unhealthy diets (Kozyrskyj et al., 2009). Children living in low-income households or poverty often experience increased stress, such as family conflict, violence, lower quality home environments, dangerous neighbourhood's and polluted air and water, which is believed to be a risk factor for asthma (Penn et al., 2007). Obesity in children and adolescents, in general, has also been associated with increased depression and anxiety. In children with asthma, obesity has been found to be associated with increased uncontrolled asthma. Low levels of physical activity can be seen in children with asthma and contribute to obesity and psychological health problems (Peters et al., 2018). According to Kant et al., (2013) Socioeconomic factors, such as housing, poverty, and restricted access to healthcare, can also significantly affect asthma prevalence and outcomes, especially for underprivileged groups.

2.2.5 Genetic factors

Previous research Fasola et al., (2022) has highlighted the fact that many susceptibility genes that confer an increased risk for the development of asthma have been established through genetic research; many of these genes require complex gene-

environment interactions. nearly half of all people affected by asthma have a genetic susceptibility either inherited genetic mutations or Single Nucleotide Polymorphisms (SNPs), increasing the risk of developing asthma, especially in combination with certain environmental factors (Bener et al., 2017). Family structure and family marriages, especially close relative marriages can raise levels of hidden genetic risks, which link to more asthma cases where such pairing are common, thus increasing inherited patterns in some regions (Mahdi et al., 2010). individuals who do not have a family background of asthma are at a 5% risk of developing asthma. Individuals who have a sibling or one of their parents suffering from asthma, the risk increases to 25%, if both their parents have asthma, the risk increases to 50%. Thus having a family history with asthma increases the risk of asthma, hence indicating that it has a strong genetic predisposition (Klaassen et al., 2015).

2.2.6 Prenatal, perinatal and Postnatal Factors

According to Augustine et al.(2022), researchers believe that delayed lung development in preterm infants, especially those without early respiratory difficulties, increases the long-term risk of asthma. Exposure to maternal smoking during pregnancy reduces neonatal lung function and increases the likelihood of developing childhood asthma. In addition, smoking during pregnancy is linked to a number of negative pregnancy outcomes, including premature delivery, which increases the risk of asthma. Childhood asthma is more common in mothers aged 20 and younger, and less common in mothers aged 30 and older (Turner et al., 2017).Additionally, grandmaternal smoking during the mother's fetal life and paternal smoking in adolescence have been identified as independent prenatal-related risks through transgenerational effects.

Prenatal contact with tobacco smoke passes through the placenta, harming early lung growth this also disrupts immune system development while encouraging changes in airway structure, raising the risk of childhood asthma(Rusconi et al., 2017). Long-term infant studies show kids born to moms who smoked during pregnancy face more diagnosed asthma cases and ongoing breathing issues when contrasted with those whose mothers didn't smoke; these differences appear early and continue into elementary years (Silvestri et al., 2021).The harmful effects are especially clear if smoking goes on during mid to late pregnancy - key stages for lung

sac formation as well as immune system setup (O'Connor et al., 2018). Though women stop smoking after giving birth, kids who were exposed before birth still face higher chances of asthma, highlighting how prenatal smoke exposure causes distinct, lasting harm (Mitchell et al., 2012).

Follow-up studies extending into teenage years and early adult life show stronger, longer-lasting asthma linked to smoke exposure before birth. Long-term cohort data reveal those exposed to smoking during pregnancy face higher chances of ongoing symptoms, need for daily meds, also reduced lung function later on unlike those not exposed. Fetal smoke contact may permanently affect breathing health (Holbrook et al., 2020). Low birth weight, premature delivery, or lack of oxygen around birth often point to poor fetal growth or weak placenta function these link to narrower airways and lasting breathing problems (Bittles et al., 2010). Such issues show up later as wheezing or asthma in kids. If a new born needs help with breathing, like ventilators or extra oxygen, it raises the danger even more because it can damage developing lungs and trigger ongoing airway inflammation (Duijts et al., 2014).

Children's genes can raise asthma risk, but early surroundings play a big role in whether symptoms start. Breathing second hand smoke soon after birth often from mom smoking can worsen lung irritation and sensitive airways in those at risk (Pattaroni et al., 2021). Inside homes, things like dust mites, roaches, or pet skin flakes may spark breathing problems when paired with common viruses such as rhinovirus or RSV. These mixtures during infancy often lead to ongoing wheezing that later becomes diagnosed asthma (Beasley et al., 2015).

2.2.7 Consanguineous marriages

Asthma stems from several genes along with outside factors, so it's shaped by many influences instead of one single cause. Having affected relatives raises likelihood; however, whether close-relative marriages matter remains uncertain because such unions usually influence conditions passed down quietly through families (Bener et al., 2009). First-cousin marriages are tied to higher asthma rates in kids because similar gene copies get passed down more often. This stronger chance comes from how genes are inherited when close relatives have children together, family traits stack up, raising the odds of breathing issues. Shared bloodlines carry heavier genetic

risks, making childhood asthma more likely when parents are related (Joseph et al., 2009). Several separate investigations across the Middle East, along with research in North Africa and parts of South Asia, show kids from closely related parents are more often diagnosed with asthma or frequent breathing issues this holds true when controlling for factors like household allergy background, income level, or pollution exposure (Trabelsi et al., 2016).

2.3 Increasing prevalence: a global perspective

The International Study of Asthma and Allergies in Childhood (ISAAC) offers the most recent data on the prevalence of asthma in children around the world. An estimated 160.7 million working individuals in the United States have asthma annually, according to the 2011–2016 national health survey (Serebrisky&Wiznia, 2019). A study conducted in Karachi says that the prevalence of asthma among children aged 3-17 is 10.2% (A. A. Khan et al., 2014). In Karachi, Pakistan, dust exposure accounts for 83% of adult asthma cases, which is a highly common condition (Iqbal et al., 2025). Phase I of ISAAC, conducted from 1994 to 1995, involved over 700,000 children aged 6 to 7 and 13 to 14 from 56 countries. Significant regional variations in the prevalence of asthma were found during the study. High prevalence countries (29–32%) were from Southeast Asia, North America, and Latin America, with the highest prevalence in Oceania (23%) and the lowest in Eurasia (8%) (M. Asher, 1998). Low prevalence countries (2–4%) were primarily from Asia, Northern Africa, Eastern Europe, and the Eastern Mediterranean. Asthma prevalence among children aged 6–7 was 11% globally, whereas among children aged 13–14, it was 9.1%, according to the most recent phase of the Global Asthma Study GAN (A. A. Khan et al., 2014).

Children with asthma miss school in Asia-Pacific (16–61%), Europe (34–68%), and the US (43%). This is also thought to be linked to lower academic achievement. According to Ren et al., (2022) preschool children of China had a higher prevalence of asthma 3.8%. 90% of children with asthma experienced symptoms because of respiratory illnesses and 67% of children with asthma symptoms have doctors' diagnosis. Preterm delivery linked to higher chances of kids developing asthma, with odds ratio at 1.49. This aspect joins other infancy-related conditions shaping lung growth and immune system changes, possibly explaining some cases

within the worldwide child asthma rate of 10.2%(Zhou & Tang, 2025). After birth, outside factors strongly impact how likely or severe asthma becomes in young ones - parental tobacco use stands out as something that can be changed. One large review found a 1.21% greater likelihood of asthma when parents smoke, adding to the overall 1.21% rise in global figures, especially where more people light up(Dharmage et al., 2019). Global rates of childhood asthma are about 10%; yet, in areas where cousin marriages are common - frequently above 30–50% in parts of the Middle East - the likelihood of kids developing asthma may rise due to more uniform gene patterns. However, research findings on this link differ (El Mouzan et al., 2008).

2.3.1 Morbidity and mortality

Although asthma is not a leading cause of morbidity and mortality in children, its incidence, impact on quality of life, and related medical costs provide strong evidence that it is a significant child health concern. In 2019 there were 461,000 asthma related deaths (Wang et al., 2023). Asthma was listed as the underlying cause of death in 5667 out of 2.3 million in united states during 1996. There were 474000 asthma hospitalization, of which 195,000occured in children less than 15 years of age (Graves and Kokaz, 1998). According to national hospital discharge survey in term of mortality 37% of asthma hospitalization occur before 15 years of age. In Korea, between 2003 and 2015 total 2831 children with asthma died (Sol et al., 2021). Approximately 250,000 individuals die prematurely from asthma each year, the majority of whom could have been saved.

Prenatal exposure to cigarette smoke from mother's raises health risks for kids who have asthma - leading to more episodes of breathing trouble, weaker lungs, or trips to urgent care. Studies show this exposure explains around 5–7% of infant deaths tied to premature birth, also 23.2% to 33.6% of sudden infant death cases; these early impacts might worsen respiratory outcomes later on due to underdeveloped lungs (Zacharasiewicz et al., 2016). In some groups, marriages between relatives occur often - up to 57.7% in places such as Saudi Arabia which raises health risks because of shared genes; this includes a greater chance of breathing disorders like asthma(Ekblad et al., 2010). Health problems tied to close family unions depend on how closely related the partners are, risk is about 32% higher for children of double first cousins, yet drops to roughly 2.5% for those whose parents are second cousins,

possibly increasing vulnerability to conditions passed through family lines(Sturm et al., 2004).

2.3.2 Global asthma burden

About 50 to 100 children are hospitalised every day in England and Scotland because of asthma, and there are about a million children with the condition in the United Kingdom. The burden of morbidity from lost exercise and education, as well as the expense from increased medication use, are also caused by increasing childhood asthma symptoms that are not regarded as an asthma exacerbation, even though they are difficult to measure. A significant section of the population suffers from childhood asthma, which affects 9.1% of children worldwide, according (Ellwood et al., 2022). Asthma accounted 21.55 million DALYs in 2019(Wang et al., 2023). Children's asthma is a major worldwide public health issue. Asthma killed 455 000 people in 2019 and affected an estimated 262 million people, according to the WHO.

Additionally, it was projected that there are 300 million asthmatics in the world now, and by 2025, that figure is predicted to increase to 400 million. Approximately 250,000 individuals die prematurely from asthma each year, the majority of whom could have been saved. Asthma in children causes 0.7% deaths per 100,000 persons worldwide. Asthma is the most prevalent chronic illness in children and is ranked in the top 20 conditions globally for children's disability-adjusted life years (Serebrisky&Wiznia, 2019).The International Survey of Asthma and Allergic Rhinitis in Childhood (ISAAC), which surveyed an astounding 1.2 million children at 233 sites spanning 98 countries, found that the incidence of asthma is 11.7% in children aged 6 to 7 and 14.1% in children aged 13 to 14(Arrais et al., 2019). In a Japanese group of 75, mother-child pairs, 7.2% of kids had bronchial asthma by age three; when mothers kept smoking during pregnancy, the adjusted odds ratio rose to 1.34% (Shima et al., 2023). For childhood asthma, global DALYs show notably high rates in lower- and middle-income nations. When parents are cousins, their children face two to three times higher chances of developing asthma. An Indian case-control analysis found 24.5% of asthmatic kids came from consanguineous unions, compared to 12.3% among healthy peers - pointing to roughly 14% of cases possibly tied to this factor there (Bener et al., 2010)

2.4 Prevalence of asthma in Pakistan

Asthma is one of the most common respiratory conditions in Pakistan, accounting for one-fourth of primary care patients. The prevalence of asthma in Pakistan is estimated to be 4.3%, affecting 7.5 million adults and 15 million children (Khan et al., 2022). The population of Pakistan, one of the most populous and economically developing countries, is more likely to suffer from asthma and other allergic diseases due to the country's increasing urbanisation, inadequate health facilities, ignorance of the disease's aetiology, increased exposure to pollutants, and consanguineous marriages. Pakistan economy spends less than 1% of GDP on healthcare, this limited healthcare capacity increases the likelihood of chronic asthma (Maqbool et al., 2025). This condition affects around 20% of Pakistan's paediatric population. Unfortunately, there aren't many studies in Pakistan that investigate the risk factors for childhood asthma. Populations with ages 4–12. In a Madan-based study determine some important risk factors for asthma, 224 (67%) of the children's fathers smoked, and 221 (68%) of the children's rooms had carpet (Klain et al., 2024).

According to Maqbool et al., (2025) the predominance of asthma among school-age children results in absenteeism, which robs them of their intelligence and wit. Many children do not receive the appropriate diagnosis and pertinent therapy, and financial limitations exacerbate the harm. Although there is a significant prevalence of asthma in Pakistan, the diagnostic rate which is unquestionably low at 9.5% is more worrisome. The situation has gotten worse due to primary healthcare practitioners' lack of understanding and appropriate treatment, which could lead to a severe health crisis.

The situation is serious because, according to an asthma report, 31.58% of school-age children in Islamabad have asthma, which is significantly higher than the 15.8% prevalence in Karachi (Sabar et al., 2018). According to the ISAAC worldwide study, 8% of Pakistani children between the ages of 13 and 14 had asthma in 1995, and 15% among 3-16 years old have asthma (Price et al., 2013). With an annual growth rate of 5%, the prevalence of asthma is increasing daily, with 20% to 30% of youngsters between the ages of 13 and 15 having the condition. Prevalence of wheeze reported by parents in 6-7 years old children ranged from 0.8% to 32.1% (Samoo & Ehsan et al., 2021). In 2013, the global asthma networks a quick study in 96 countries.

The survey found that 40% of countries have their own asthma management standards. Low- and middle-income countries including Ethiopia, India, Nigeria and Palestine established their own guidelines. In this survey we also found out that Pakistan generally follows GINA guidelines. GINA have largely been followed. However, efficient implementation demands a strong strategy and constant vigilance (Maqbool et al., 2025).

In Pakistan, tobacco use by mothers during pregnancy continues to raise concerns even though only about 3.2% report regularly smoking cigarettes, usage of smokeless forms reaches close to 10%, while products such as chillum or huqqa exceed 7%(Rozi et al., 2016). Exposure to second hand smoke after birth typically tied to mother's or family members' behaviour is linked to breathing issues in roughly 39.1% of impacted kid, findings from a survey of 217 children under age 12 in Sindh reveal strong connections with coughing, difficulty breathing, and tiredness(Qadri et al., 2024). Nationwide data suggest some 15 million children live with asthma, where prolonged contact with harmful fumes like those from tobacco is named a key trigger - but how much prenatal exposure specifically contributes still needs more region-focused studies(M. A. Khan, 2022). Pakistan has among the world's highest levels of cousin marriages - about 60–70% of couples are closely related - shaped by tradition, religion, family ties, also financial reasons; this pattern hasn't changed much in years. While hard numbers linking such unions directly to child asthma are lacking, nationwide records show 15 million kids live with asthma, where inherited risks including close-relative marriage play a role along with pollution or allergens, yet precise local evidence connecting both is still limited(Iqbal et al., 2022).

CHAPTER THREE

RESEARCH METHODOLOGY

This study investigates the prevalence of asthma and its risk factors in school children of Islamabad using a quantitative approach. The study determined the impact of environmental, sociodemographic and genetic factors in development of asthma in children.

3.1 Research design

Cross sectional study survey design serves the purpose of research to collect data from a single point in time. The established research design enable researcher to observe and analyse the prevalence and risk factors of asthma in school children in Islamabad. Research has done a survey design to analyse the population through

quantitative methods while avoiding continuous tracking. The study captured a current view of prevalence of asthma and its risk factors.

3.2 Sampling techniques

Purposive sampling technique was used, that focus on specific population, so we can deeply understand the factors effecting children, this cannot be globalised as it is done in two random schools. Participants are selected based on willingness to participate.

3.3 Sampling and data collection

Data was collected from a representative sample of a school children in Islamabad using structured questionnaire adapted from the ISAAC protocol, was used to collect data on asthma symptoms, environmental exposures, family history, and socio-demographic information. The data was collected online using google form, questionnaire was also translated in Urdu for better understanding.

3.4 Universe

This study took place in random (anonymous) schools of Islamabad. This study focused on school children aged 5 to 17 years.

3.5 Population frame

It included children within the age of 5 to 17 attending Islamabad school were investigated, because Islamabad season and geographical area make it more susceptible to asthma.

3.6 Sample size calculation

Using the prevalence rate of 31.58% in Islamabad school children reported by Sabar et al., (2018), the sample size was calculated through openepi.com which was found to be 332.

With 95% confidence level and 5% margin of error.

3.7 Data analysis technique

This is a correlation study and collected data was analysed using SPSS software, employing descriptive statistics and correlation analysis to identify significant risk factors.

3.8 inclusion and exclusion criteria

inclusion

- Children attending Islamabad schools
- Willing to participate
- Aged 5-17 years

Exclusion

- Children below 5 year of age
- Chromosomal abnormalities
- Disability
- Chronic disease
- Any questionnaire with missing or inconsistent data was excluded from the final analysis

3.9 Ethical considerations

Every parent or legal guardian of the youngsters were asked for their informed consent. Participants were guaranteed anonymity and confidentiality. Participants may discontinue participation at any moment; it was entirely voluntary. Furthermore, all the protocols were adhered completely to the field's ethical principles and research methods, placing the highest priority on protecting respondents' privacy and consent throughout the study

CHAPTER FOUR

DATA ANALYSIS

This chapter presents the results obtained from 333 school-going children aged 5–17 years in Islamabad, Pakistan. Data were collected using a structured questionnaire adapted from the ISAAC protocol. All analyses were performed using IBM SPSS version 26. Descriptive statistics (frequencies and percentages) are reported for sociodemographic characteristics, prevalence indicators, environmental exposures, and family history/genetic factors. Inferential statistics (Pearson Chi-square tests) were used to examine associations between doctor-diagnosed asthma (the primary outcome) with key risk factors.

Building on the descriptive foundation, the correlation analyses illuminate robust links between asthma diagnosis and key influences, employing statistical tests to discern meaningful patterns. Sociodemographic elements reveal notable ties, where certain gender tendencies align with established biological patterns in youthful populations, and parental education emerges as a proxy for broader socioeconomic gradients that influence access to cleaner environments and timely care. We discuss these as gateways to understanding inequities, where societal structures subtly steer

health trajectories, advocating for policies that level the playing field through education and support.

4.1 DESCRIPTIVE ANALYSIS

Table 1. sociodemographic frequency distribution

Characteristics	categories	Frequency	percentage
Student age	5-8	124	37.2
	9-12	91	27.3
	13-17	118	35.4
Gender	Male	193	58.8
	female	140	42.0
School type	Public	214	64.3
	Private	119	35.7
Residence	Urban	222	66.7
	Rural	22	6.6
	Semi-urban	89	26.7
Type of housing	Rented	150	45.0
	Owned	116	34.8
	Shared	61	18.3
	Government	6	1.8
Father education	No formal	14	4.2
	Primary	16	4.8
	Secondary	58	17.4
	University or above	245	73.6
Mother education	No formal	42	12.6
	Primary	42	12.6
	Secondary	116	34.8
	University or above	133	39.9
Father occupation	Unemployed	12	3.6
	Laborer	10	3.0
	Skilled worker	34	10.2

	Teacher/clerk	77	23.1
	Professional	188	56.5
	Other	12	3.6
Mother occupation	Unemployed	14	4.2
	Laborer	6	1.8
	Skilled worker	10	3.0
	Teacher/clerk	81	24.3
	Professional	54	16.2
	Housewife	168	50.5
Monthly household income	Low	101	30.3
	Middle	170	51.1
	High	62	18.6
Main source of drinking water	Tap water	154	46.2
	Filtered	171	51.4
	Well	8	2.4

The sociodemographic information of 333 children is shown in this table. Whose age ranged from age 5 to 17. The age distribution was relatively balanced across the sample. specifically, a total of 124 (37.2%) student was aged 5-8 years. a total of 91 students 27.3% were 9-12 years old. the age of 13-17 years constitutes 118 participants making up 35.4% of the total sample. In terms of gender, the sample consisted of 193 males, representing 58.0% and 140 females, comprising 42.0% of the total. this indicates a slightly higher male representation in the study population.

Regarding school type, the majority of students that attended public schools were 214 students with 64.3% falling in that category and 119 students with 37.7% were enrolled in private schools. The residential status of the students revealed that urban areas accounted for the largest proportion with 222 students making 66.7% residing in cities. A much smaller proportion 22 students making 6.6 percent lived in rural areas while 89 students making 26.7 percent were from semi urban settings. This indicates that the majority of the participants come from urbanized environments. In terms of housing types, nearly half of the families lived in rented houses accounting for 150 students making 45.0%. Another 116 students making 34.8% reported living in owned houses, meanwhile 61 families making 18.3% lived in shared houses, and a

small minority of 6 families making 1.8 percent were residing in government provided housing.

Father's education level showed a strong presence of higher educational attainment only 14 fathers making 4.2 percent had no formal education and 16 fathers making 4.8 percent had completed primary schooling A total of 58 fathers making 17.4% had secondary education Whereas the vast majority 245 fathers making 73.6% possessed a university degree or higher This indicates that most fathers in this sample were well educated similarly mothers education varied but showed a slightly bordered spread Mothers with no formal education and those with primary education each constituted 12.6% of the sample Having 42 mothers for each category. A large group of 116 mothers making 34.8 percent had completed secondary education.

Additionally, 113 mothers making 39.9% held a University level qualification or higher reflecting relatively high educational attainment among mothers as well. The data also included information on father's occupation Only twelve fathers making 3.6 percent were unemployed while ten fathers making 3.0% Worked as labourer's. A total of 34 fathers Making 10.2 percent were employed as skilled workers, and 77 fathers making 23.1% were categorized as teacher or clerk. The majority of others 188 fathers making 56.5% held professional positions, it shows that families belong to higher socioeconomic bracket additionally twelve fathers making 3.6 percent were reported under others occupational category. Deception on mother's occupation contained two categories in the visible data unemployed which included 14 mothers making 4.2 percent and labourer's with 6 mothers making 1.8%. Ten mothers making 3.0% were listed as skilled workers 81 mothers making 24.3% as teachers or clerk Fifty-four mothers making 16.2% as professionals and the largest group 168 mothers making 50.5% were classified as housewives. In terms of monthly household income 101 families Making 30.3% were categorized in Low Income group, 170 families making 51.1% were in middle income group, whereas 62 families making 18.6% were classified as having a high income. The main source of drinking water used by the families revealed that 154 students making 46.2 percent relied on tap water while 171 students making 51.4% consumed filter water only eight students making 2.4% Reported using well water

Table 2. family member, sibling, rooms and sleeping arrangements in household.

Characteristics	categories	Frequency	percentage
Number of family members living in the house	3-5	124	37.2
	6-8	170	51.1
	9-12	39	11.7
Number of siblings	0-3	140	42.0
	4-7	177	53.2
	8-10	16	4.8
Number of rooms in the house	2-4	233	70.0
	5-7	88	26.4
	8-10	12	3.6
Average Sleeping arrangements	Shared with 1 person	176	37.8
	Shared with 2 persons	112	33.3
	Shared with 3 or more persons	20	6.0
	Not shared	76	22.8
Does the child usually sleep in a room alone?	Yes	122	36.6
	No	211	63.4

The distribution of family size measured by the number of family members living in each household showed considered variation among the participant 124 students making 37.2% lived in households with 3-5members, while 170 students making 51.1% lived with 6-8 family members. 39 families consisting of 9-12 members were making up 11.7% of the sample.

The data on the number of siblings showed similar diversity a proportion of 140 students making 42.0% reported having 0-3 siblings, whereas 177 students making 53.2% had 4-7 siblings. 16 families with 8-10 siblings made up 4.8% of the sample.

Information on number of rooms in the household further illustrate differences in living space, 233 students making 70.0% lived in homes with 2-4 rooms. 88 homes with 5-7 rooms representing 26.4% of the sample, and 8-10 rooms reported by 12 students making up to 3.6%.

The data on sleeping arrangements showed that shared sleeping spaces were common among the students. Majority of children of 176 students making 37.8% shared a sleeping space with 1 person while 112 student making 33.3% shared with two persons a small proportion of 20 students making 6.0% shared their sleeping space with three or more persons. On the other hand, seventy-six students making 22.8% Reported that they did not share their sleeping arrangement with anyone.

When asked whether the child usually sleep in room alone the responses further highlighted differences in privacy a total of 112 student making 36.6% stated that they share sleep alone in a room, while a large proportion of 211 students making 63.4% reported that they do not sleep alone.

Table 3. Prevalence of asthma in school children of Islamabad

Characteristics	categories	Frequency	percentage
Has your child ever had wheezing or whistling in the chest at any time in the past?	Yes	259	77.8
	No	74	22.2
In the past 12 months, has your child had wheezing, whistling or tightness in the chest?	Yes	271	81.4
	No	62	18.6
How many attacks of wheezing has your child had in the past 12 months?	1-3	161	48.3
	4-12	88	26.4
	More then 12	18	5.4
	None	66	19.8

In the past 12 months, how often has wheezing limited your child's speech to only one or two words at a time between breaths?	Occasionally	146	43.8
	Rarely	42	12.6
	Frequently	95	28.5
	Never	50	15.0
child's sleep been disturbed due to wheezing in the past 12 months?	Once or more per week	223	67.0
	Less than once a week	56	16.8
	Never	54	16.2
Has your child ever been diagnosed with asthma by a doctor?	Yes	247	74.2
	No	86	25.8
Has your child ever used an inhaler or asthma medication prescribed by a doctor?	Yes	241	72.4
	No	92	27.6
Has your child had a cold or chest infection, in the past 12 months?	Yes	259	77.8
	No	74	22.2
Has your child had a dry cough at night, apart from a cold or chest infection, in the past 12 months?	Yes	96	28.8
	No	181	54.4
	Sometimes	56	16.8
In the past 12 months, has coughing, wheezing or breathlessness been a problem when your child is exercising or playing?	Yes	229	68.8
	No	74	22.2
	Sometimes	30	9.0
Does your child have access to a regular healthcare provider?	Yes	289	86.8
	No	44	13.2

Where do you usually seek medical care for your child?	Governmental hospital	174	52.3
	Private clinic	114	34.2
	Traditional healer	30	9.0
	Pharmacy	15	4.5
Has your child missed school due to respiratory illness in the past year?	Frequently	167	50.2
	Rarely	46	13.8
	Occasionally	74	22.2
	Never	46	13.8
Does your child have any other allergic conditions?	Hay fever	62	18.6
	Eczema	37	11.1
	Food allergies	37	11.1
	None	197	59.2
child ever been hospitalized for wheezing or asthma?	No	136	40.8
	1 time	69	20.7
	2 times	90	27.0
	3 times	32	9.6
	4 or more times	6	1.8

This table shows a high prevalence of respiratory symptoms among school age children in Islamabad a large majority of 259 parents making 77.8% reported that their children had ever experienced wheezing or whistling in the chest while only 72 children making 22.2% Had never experienced these symptoms. In the past 12 months 271 children making 81.4% experience experienced wheezing whistling and feeling of tightness in the chest, whereas 62 children making 18.6% did not experience these symptoms during the same period. When assessing the frequency of wheezing attacks in the last 12 months the largest group of children of 161 children making 48.3% reported 1-3 attacks while 88 children making 26.4% experienced four to twelve attacks within the year. A smaller proportion of 18 children making 5.4 percent had more than twelve attacks. 66 children making 19.8% reported no wheezing attack in

the past year. Regarding the severity of wheezing episode parents reported how often wheezing limited their child's ability to speak. Occasionally this occurred for 146 children making 43.8% while 42 children making 12.6% experience this limitation rarely. More concerning 95 children making 28.5% experienced speech limiting wheezing frequently, and 50 children making 15.0% never faced such difficulty.

Sleep disturbances due to wheezing was also common 223 children making 67.0% had their sleep affected once or more per week while 56 children making 16.8% experienced sleep disruption less than once a week. Another 54 children making 16.2 percent had no sleep disturbance. A substantial number of children had received a formal diagnosis 247 children making 74.2% had been diagnosed with asthma by a doctor whereas 86 children making 25.8% had not been given the diagnosis despite the presence of symptoms in many cases. Similarly, 241 children making 72.4% had used an inhaler for asthma medication prescribed by the doctor, including nebulizer and oral medicines while 92 children making 27.6 had never used such medications. In the past year 259 children making 77.8% had a cold or chest infection while only seventy-four children making 22.2 did not experience such illnesses. In term of dry cough 96 children making 28.8% experienced it 181 children making 54.4% reported none and 56 children making 16.8% had such curves sometimes exercise induced symptoms were also significant 229 children making 68.8% experienced coughing wheezing and breathlessness during play or exercise Thirty children making 9.0% experience this sometime and 74 children making 22.2 percent did not experience these symptoms at all. Access to healthcare services were generally good 289 children making 86.8% had access to a regular health care provider while 40 four children making 13.2% did not.

When seeking medical care, more than half of the families 174 families making 52.3% preferred government hospitals, while 114 families making 34.2% used private clinics. 30 families making 9.0% sought help from traditional healers, and 15 families making 4.5% directly from pharmacies. Cool absentee due to respiratory illness was also noted 167 children making 50.2% frequently missed school. While 74 children making 22.2% missed school occasionally. Forty-six children making 13.8% reported rare absence and another 46 children making 13.8 percent had never missed school because of respiratory issues. Other allergic

conditions were assessed among the children. 62 children making 18.6% had hay fever while 37 children making 11.1% had eczema and another 37 children making 11.1 percent had food allergies. However, the majority 197 children making 59.2% did not have any additional allergic conditions. Hospitalization History Due to Wheezing or Asthma Revealed varying levels of severity. 136 children making 40.8% had never been hospitalized while sixty-nine children making 20.7% had been admitted once. A notable 90 children making 27.0% Had been hospitalized two times. 32 children making 9.6 percent had been hospitalized three times and six children making 1.8 percent had been hospital 4 or more times.

Table 4. Environmental factors

characteristics	categories	frequency	percentage
Does anyone in your home smoke cigarettes?	Yes	225	67.6
	No	108	32.4
Was the mother exposed to smoking during pregnancy?	Yes	173	52.0
	No	154	46.2
	Sometimes	6	1.8
Type of cooking fuel used at home:	Wood/biomass	35	10.5
	Gas	288	86.5
	Coal	10	3.0
Do you use a wood-burning stove or an open fire for heating in your home?	Yes	165	49.5
	No	164	49.2
	Sometimes	4	1.2
Is your kitchen separate from the living/sleeping area?	Yes	245	73.6
	No	88	26.4
Does your child's bedroom have:?	Visible dampness or mold	40	12.0
	Carpets/rugs	98	29.4
	Heavy curtains	100	30.0
	Pets(cat, dog, birds)	90	27.0
	None of the above	5	1.5
Is there visible mold, dampness, or water leakage in your home?	Yes	185	55.6
	No	148	44.4
Do you often keep windows closed at home?	Yes	243	73.0
	No	90	27.0

Do you use mosquito coils or incense sticks inside your home?	Yes	197	59.2
	No	136	40.8
Is there a lot of dust in your home?	Yes	183	55.0
	No	150	45.0
How often does your child eat fast food (e.g., burgers, fries, pizza)?	1-2 times per week	164	49.2
	3 or more times per week	51	15.3
	Rarely	84	25.2
	Never	34	10.2
does your child spend time outdoors in areas with heavy traffic/pollution?	Sometimes	92	27.6
	Daily	167	50.2
	Rarely	38	11.4
	Never	36	10.8
Is your home located near heavy traffic, industrial zones, or construction sites?	Yes	213	64.0
	No	120	36.0
Does your child attend a school located in an area with heavy traffic or high pollution?	Yes	227	68.2
	No	106	31.8
How often does your child play outdoors?	Daily	235	70.6
	Weekly	66	19.8
	Rarely	32	9.6
Are there frequent dust storms or high pollen seasons in your area?	Frequently	79	23.7
	Sometimes	136	40.8
	Rarely	48	14.4
	Never	70	21.0
During which month?	January	20	6.0
	April	21	6.3
	October	83	24.9
	July	32	9.6
	December	23	6.9
	No response	154	46.2
Are insecticides or chemical sprays used inside the home?	Frequently	88	26.4
	Occasionally	111	33.3
	Rarely	48	14.4
	Never	86	25.8
	Autumn	34	10.2
	Summer	68	20.4
	Winter	71	21.3
Spring	93	27.9	
Is your home adequately ventilated during extreme weather (e.g., cold, heat)?	Yes	243	73.0
	No	90	27.0
Does your child use air conditioning or heating devices regularly?	No	142	42.6

	Electric heater	106	31.8
	Gas heater	54	16.2
	AC unit	31	9.3
In the past 12 months, has your child's wheezing or coughing been triggered or worsened by any of the following?	Dust	45	13.5
	Exercise	26	7.8
	Pollen or seasonal changes	87	26.1
	Strong smells	38	11.4
	Outdoor pollution	51	15.3
	Cold air	58	17.4
	None	28	8.4

This table portrays the results of environmental factors and reveals that significant exposure to indoor and outdoor risk factors among school children in Islamabad. The large majority of households 225 families making 67.6% reported that someone at home smokes cigarettes, whereas 108 households making 32.4% were smoke free. Maternal exposure to smoking during pregnancy was also notable 173 mothers making 52.0% were exposed Why 154 mothers making 46.2 percent were not, six mothers making 1.8 percent were exposed sometimes. Regarding domestic fuel use 288 families making 86.5% relied on gas for cooking, while 35 household making 10.5% used wood or biomass, and ten household making 3.0% used coal, when asked about heating sources, 165 families making 49.5% reported using wood burning stoves or open fires while 164 families making 49.2% did not, and four families making 1.2 percent used sometimes.

245 Household making 73.6% add a separate kitchen Whereas 88 households making 26.4% add kitchen in the living or sleeping area. Environmental features in the child's bedroom includes carpet or rugs in 98 home making 29.4%, Hundred homes making 30.0% have heavy curtains and 90 homes making 27.0% have pets such as cats dogs or birds. Visible dampness or mold was present in 40 homes making 12.0%, While only five homes making 1.5% reported none of these factors. Moisture related issues were common throughout the houses 185 families making 55.6% a reported visible mold dampness or water leakage, while 148 families making 44.4% reported none. Ventilation practices showed that 243 households making 73.0% often kept windows closed, and 90 households making 27.0% did not close the window. Additionally, 197 household making 59.2% used mosquito coils, compared to 136 household making 40.8% who did not. Dust exposure was also significant with 183

households making 55.0% reporting excessive dust while 150 homes making 45.0% reported otherwise.

Children's dietary habits revealed that 164 (49.2%) ate fast food 1-2 times per week, while 51 (15.3%) ate it three or more times per week. Fast food consumption was uncommon among 84 children (25.2%), while 34 children (10.2%) never ate fast food. Outdoor pollution exposure was likewise significant, with 167 children (50.2%) spending time in high-traffic or polluted places on a daily basis and 92 children (27.6%) doing so sometimes. Only 38 youngsters (11.4%) were seldom exposed, while 36 (10.8%) were never exposed. In addition, 213 homes (64.0%) were near heavy traffic, industrial zones, or construction, whereas 120 homes (36.0%) were not. Similarly, 227 children (68.2%) attended schools in high-traffic or polluted regions, whereas 106 (31.8%) went to schools in cleaner settings.

Outdoor activity was common among the youngsters, with 235 (70.6%) playing outside daily, 66 (19.8%) doing so weekly, and 32 (9.6%) playing outside just occasionally. Seasonal environmental conditions differed by region: 79 families (23.7%) reported frequent dust storms or high pollen seasons, 136 families (40.8%) experienced them occasionally, 48 families (14.4%) experienced them infrequently, and 70 families (21.0%) never encountered such conditions. When asked whether months were connected with deteriorating environmental conditions or symptoms, October was the most often mentioned (83 replies, 24.9%). Smaller proportions reported July (32, 9.6%), December (23, 6.9%), April (21, 6.3%), and January (20, 6.0%), while 154 respondents (46.2%) did not identify a month. Household chemical exposure was also recorded. Insecticides or chemical sprays were utilised in 111 households (33.3%), 88 homes (26.4%), 48 homes (14.4%), and 86 homes (24.8%). Seasonal worsening of respiratory symptoms varied greatly: 93 children (27.9%) reported symptom worsening in spring, 71 children (21.3%) in winter, 68 children (20.4%) in summer, and 34 children (10.2%) in autumn, while 67 children (20.1%) reported no seasonal variation. During harsh weather, 243 families (73.0%) had adequate household ventilation, whereas 90 families (27.0%) reported inadequate ventilation.

Table 5. Genetic factors

characteristics	Categories	frequency	percentage
Has the child's Mother ever been diagnosed with asthma?	Yes	175	52.6
	No	158	47.4
Has the child's father ever been diagnosed with asthma?	Yes	163	48.9
	No	170	51.1
Do any siblings have asthma?	Yes	161	48.3
	No	172	51.7
Do any siblings have allergic conditions? (eczema, hay fever)	Yes	154	46.2
	No	179	53.8
Does either parent have a history of allergic conditions?	Yes	135	40.5
	No	198	59.5
Is there a history of other respiratory, allergic conditions in the family (parents or siblings)?	No	129	38.7
	Eczema	46	13.8
	COPD	124	37.2
	Food allergies	34	10.2
Has any grandparent (maternal or paternal) been diagnosed with asthma?	Yes	165	49.5
	No	154	46.2
	Don't know	14	4.2
Is there a known family history of genetic disorders or immune system conditions?	No	273	82.0
	Diabetes	34	10.2
	Genetic disorder	12	3.6
	Thyroiditis	2	0.6
	Autism	4	1.2
	Arthritis	6	1.8
	Dementia	2	0.6

Are the child's parents related by blood (cousin)?	Yes	213	64.0
	No	120	36.0
Has any close family member(uncle, aunt, cousin) had asthma, eczema ,hay fever?	Yes	201	60.4
	No	98	29.4
	Don't know	34	10.2

The statistics show a significant hereditary propensity to asthma and allergy disorders among the children surveyed. More than half of the moms (52.6%; 175 children) had previously been diagnosed with asthma, showing a high maternal role in the inherited risk of respiratory diseases. Paternal asthma was slightly less common, with 48.9% (163 fathers) diagnosed as asthmatic and 51.1% (170) having no history of asthma. This very equal distribution demonstrates that maternal and paternal asthma are significant genetic factors. Siblings play a significant role in understanding familial patterns. Nearly half of the children (48.3%; 161) had asthmatic siblings, compared to 51.7% (172) who did not have asthma. Amongst the participants, 46.2% (154) said their brothers or sisters had allergies such as eczema or hay fever; in contrast, 53.8% (179) stated they did not. These figures indicate that allergic conditions - especially ones linked to asthma - are fairly frequent within close relatives.

Parental allergies were also checked. In 40.5% of cases - 135 instances - one or both parents had allergic conditions; however, most - 59.5%, or 198 families - had no such history. Although not common, these inherited factors still contribute significantly to a child's likelihood of developing allergies. Looking at the full family background, covering parents and brothers or sisters, 38.7% (129 families) showed no signs of breathing issues or allergic diseases. Eczema appeared in 13.8% (46 cases), while COPD showed up in 37.2% (124 instances); food allergies were seen in 10.2% (34 people). The notable frequency of COPD highlights ongoing vulnerability to breathing issues across generations - this goes further than just asthma. When it comes to grandparent-level asthma, nearly half - 49.5% (165) - said their grandparents had it; slightly fewer - 46.2% (154) - reported no occurrence; meanwhile, a small group - 4.2% (14 individuals) - were unsure. Such distribution suggests lung conditions travel

through family lines, pointing toward inherited patterns reaching past parents and children. Regarding wider health concerns tied to genes or immunity, most participants - 82% (273 people) - did not report any background history. Some conditions appeared less often: diabetes in 10.2% (34 cases), genetic issues in 3.6% (12), thyroiditis in 0.6% (2), autism in 1.2% (4), arthritis in 1.8% (6), dementia also in 0.6% (2). Even though these numbers are small, they still hint at broader hereditary patterns influencing child well-being.

A key result concerns family relatedness: 64% (213) of kids had parents who were cousins, whereas 120 (36%) came from non-related couples. This matters genetically - marriages between relatives can raise chances of receiving hidden gene traits, which might link to higher risks in breathing issues or allergic reactions.

The poll asked if extended family members, such as uncles, aunts, or cousins, experienced asthma, eczema, or hay fever. The vast majority (60.4%; 201) stated that these illnesses existed in their extended family, whereas 29.4% (98) had no such history and 10.2% (34) were doubtful. This confirms the pattern of hereditary allergy and respiratory disorders that spans numerous generations and family lines.

4.2 CORRELATION ANALYSIS

Table 6. Correlation of asthma with sociodemographic factors

Items	yes	no	Chi-square	P value
Childs gender				
Male	155	38	9.025	0.003
Female	92	48		
Parents education:				
No formal	10	4		
Primary	6	10	13.943	0.003
Secondary	40	18		
University or above	191	54		

As the chi-square analysis of the provided contingency table shows, there are statistically significant relationships between childhood asthma and particular

sociodemographic factors, in particular the gender of the child and the level of education of the father; the level of educational attainment of the mother showed a marginally non-significant trend.

The correlation established between the gender of the child and the prevalence of asthma showed significant association of $p=0.003$. In the asthmatic cohort; 155 males and 92 females respectively were registered; the non-asthmatic cohort had 38 males and 48 females respectively. These findings denote that male children in this group of school children are significantly more likely to have asthma than their female counterparts, which is supported by what is well documented in regards to the world population that indicates that boys in childhood (before puberty) are more likely to experience asthma, with the gender distribution reversing once they reach adolescence.

There was a statistically significant relationship between the educational level of parents and the prevalence of childhood asthma $p = 0.003$. Teenagers whose paternal guardians had either no formal education or only primary education were overrepresented in the asthmatic group (10 and 40 cases, respectively) as compared to non-asthmatics (4 and 18 cases). Conversely, the children of those parents who had left university-level education (or above) were significantly underrepresented amongst asthmatics (six cases only) in comparison with the non-asthmatics cohort (54 cases). These results suggest a strong negative correlation, in which low paternal education levels are associated with a high risk of childhood asthma, which may reflect socioeconomic disadvantage, restricted access to healthcare, poor residential conditions, or low awareness on the topic of both of asthma management and environmental risk factors.

Amongst this group of school-going children, male sex and low paternal education were highly correlated with increased asthma cases, which once again highlights the presence of both biological (sex) and socioeconomic (paternal education, which is also a proxy of household socioeconomic status) factors on the risk of asthma.

Table 7. Correlation of asthma with environmental factors

Items	yes	no	Chi-square	P value
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Smoke exposure				
Yes	183	64	18.562	<0.001
No	42	44		
Home located near traffic/industrial sites				
Yes	179	68	30.018	<0.001
No	34	52		
Child attend school in area with traffic/pollution				
Yes	189	58	30.731	<0.001
No	38	58		
Respiratory symptoms worsen during specific season				
No	21	46		
Autumn	30	4	83.949	<0.001
Summer	62	6		
Winter	61	10		
Spring	73	20		

The current research has shown that there is strong correlation between asthma and various environmental exposures. There were significant differences between the rate of asthma in children who were exposed (183 children) or not exposed (64 children) to household smoke. The relationship is statistically significant ($\chi^2 = 18.562$, $p < 0.001$) which means that smoke exposure is a robust environmental risk factor that leads to asthma prevalence.

On the same note, the home address of the child also exhibited a significant correlation with the symptoms of asthma. A significantly greater prevalence of asthma was shown in children who lived near traffic-prone or industrial regions (179 cases), but much lower prevalence was observed in children who lived in regions that were far (68 cases). The correlation was very important ($\chi^2 = 30.018$, $p < 0.001$), which validates that automobiles and industrial generated pollutants are very instrumental in causing or worsening asthma.

The environmental association was further cemented by the fact that the children were attending schools in high-traffic or polluted areas. Children who

attended schools in dirty areas were found to record much more symptoms of asthma (189 cases) than those that attended schools in cleaner environments (58 cases). This correlation was significant ($\chi^2 = 30.731$, $p = -0.001$) and highlighted the fact that school-going children are more susceptible to respiratory infections when they are exposed to air pollution so much in a day.

Also observed is seasonal variation with a significant influence on the severity of respiratory symptoms. Most children with asthma were found to have symptom exacerbations in the spring (73 cases), winter (61 cases), and summer (62 cases), and lower numbers were found in the autumn (30 cases) and those who did not report a seasonal effect (21 cases). The correlation was very high ($\chi^2 = 83.949$, $p 0.001$) which indicated that seasonal allergens, temperature variations, and the probability of infections are among the factors increasing asthma exacerbations.

Table 8. Correlation of asthma with genetic factors

Items	Yes	no	Chi-square	P value
Child parents related by blood(cousin)				
Yes	181	66	36.006	<0.001
No	32	54		
Mother ever been diagnosed				
Yes	147	100		
No	28	58	18.589	<0.001
Father ever been diagnosed				
Yes	147	100	42.722	<0.001
No	16	70		

The findings show a clear link between genes and asthma in kids. Kids whose moms had asthma showed more symptoms 147 instances unlike those whose moms didn't, with only 100. This connection held weight ($\chi^2 = 18.589$, $p < 0.001$), pointing to mom's asthma as a key inherited factor. While numbers differ, the pattern supports genetics playing a role.

A comparable yet more pronounced link appeared when considering father's asthma. Kids whose dads had asthma showed 147 instances clearly above the 100 found in

children without such family background. The connection proved highly significant ($\chi^2 = 42.722$, $p < 0.001$), suggesting inherited factors from fathers might strongly affect asthma risk.

Families where parents are closely related like cousins had more kids with asthma. Kids from these family lines saw 181 asthma diagnoses, while those from unrelated parents had only 66. This link stood out clearly in the data ($\chi^2 = 36.006$, $p < 0.001$). So, shared genes between mothers and fathers might raise the chance of passing on risks tied to asthma. genetics play a big role in childhood asthma, where family history and close-relative parentage stand out as main risks. High chi-square scores together with clear p-values point to inheritance being central here.

CHAPTER FIVE

DISCUSSION AND CONCLUSION

DISCUSSION

The present study conducted among 333 school-aged children (5–17 years) in Islamabad, whose main objectives was to find asthma prevalence in school children and analyse the environmental, genetic, and socio-demographic factors associated with asthma occurrence in children revealed an exceptionally high burden of childhood asthma and respiratory symptoms. Lifetime wheezing, wheezing in the past 12 months and physician-diagnosed asthma were higher than most previous Pakistani estimates, which ranged from 10–20% (Khan et al., 2014; Samoo& Ehsan, 2021), and even exceed the 31.58% physician-diagnosed prevalence previously reported for Islamabad by Sabar et al. (2018). The dramatically elevated rates observed here are comparable only to selected high-risk urban cohorts globally and suggest either a true rapid increase in asthma burden in the capital over the past decade or, more likely, a combination of heightened parental awareness, broader symptom inclusion, and recruitment from schools located in highly polluted zones of Islamabad. Similar

unexpectedly high symptom prevalence has been documented in other rapidly urbanizing middle-income cities when ISAAC-based questionnaires were applied in traffic-congested areas (Arrais et al., 2019; Fasola et al., 2022).

Environmental exposures in this study emerged as the strongest modifiable risk factors, household smoke exposure and living near heavy traffic or industrial areas were independently associated with significantly higher asthma prevalence, this was also reported by Khreis et al., (2017) that tobacco smoke and traffic-related air pollutants (especially NO₂ and particulate matter) are major drivers of childhood asthma onset and exacerbations in low- and middle-income countries.

The finding that majority of children attended schools in high-traffic/polluted locations further compounds daily exposure, mirroring results from Karachi where proximity of schools to major roads dramatically increased asthma risk (Khan et al., 2014). Indoor dampness/mold, mosquito coil use, and excessive dust were also highly prevalent and significantly correlated with asthma, aligning with meta-analyses that rank these factors among the most consistent indoor triggers worldwide (Dick et al., 2014).

Genetic predisposition played a prominent complementary role. Parental history of asthma was astonishingly high, far exceeding most international cohorts (Burke et al., 2012) and previous Pakistani reports (Sabar et al., 2018). Consanguineous marriage of parents much higher than the national average is particularly noteworthy, as cousin marriages have been repeatedly linked to increased asthma and atopy risk through homozygous expression of recessive susceptibility alleles (Mahdi et al., 2010; Bener et al., 2017). A school-based study in Islamabad using the ISAAC protocol similarly identified parental consanguinity as a significant risk factor for childhood asthma and allergic diseases, reporting that children of consanguineous parents had markedly higher odds of physician-diagnosed asthma and wheezing (Waqar et al., 2009) The combination of strong familial aggregation and high consanguinity likely amplifies genetic risk in this population beyond what is seen in outbred communities, a pattern also observed in other Middle Eastern and South Asian settings with similar marriage practices (Asher et al., 2021).

Socio-demographic associations further contextualized the findings. Male gender predominance accords with the well-established pre-pubertal male excess in asthma prevalence documented globally and in earlier Pakistani studies (Khan et al., 2022), same is shown by Waqar et al. (2009) that there is high prevalence of asthma in boys. Lower paternal education was significantly associated with higher asthma prevalence, reflecting socioeconomic gradients repeatedly shown in both high- and low-income countries where poorer education correlates with increased exposure to environmental triggers, delayed diagnosis, and suboptimal management (Asher et al., 2021; Fasola et al., 2022).

Seasonal exacerbation was pronounced, with spring, winter, and summer peaks, consistent with pollen-driven worsening in spring and viral/respiratory infection triggers during winter school reopening patterns previously described in Pakistan and neighbouring regions (Yang et al., 2021).

This study demonstrates that childhood asthma in urban Islamabad has reached alarming proportions, driven by an unfortunate convergence of intense environmental pollution, widespread tobacco-smoke exposure, poor indoor air quality, and a strong genetic predisposition amplified by high rates of consanguineous marriage. These findings are largely consistent with but more extreme than previous regional research and underscore the urgent need for multi-sectoral interventions targeting smoke-free homes, improved urban planning to separate schools and residences from traffic/industry, enhanced indoor ventilation, and genetically informed screening in consanguineous families.

5.1.1 Research limitation

This is a cross sectional study design, which collects data at a single point in time, limit the ability to draw conclusion about the casual association between asthma and its other risk factors, so that's why large and diverse sample might yield a positive relation. The sample was taken from selected schools in Islamabad, the finding may not fully represent all children in Islamabad. Data was obtained from parents of children's, parents who are bias responders may not understand the degree to which factors affect them when relied on self-reported data. Parents may not recall exact diagnoses, leading to under or over-reporting.

5.1.2 Recommendations for future

Conduct a larger truly population based study in Islamabad with random selection of schools and classes aiming for at least 1500-2000 children. Conduct a large research on other factors that cause asthma in children. Future studies could combine questionnaires with clinical examinations and test to improve accuracy, monitoring tools would give a more complete picture.

CONCLUSION

The present study “assessing the frequency of asthma and its risk factors in school children of Islamabad” is designed to investigate the prevalence of asthma among school-going children in Islamabad and the various environmental, genetic, and sociodemographic factors that predispose them to the condition. This indeed is an important health problem, as most children have symptoms like wheeze, chest tightness, and breathlessness over the last year; a significant number also reported physician-diagnosed asthma with at least one to three asthma attacks in the last 12 months. Asthma appears to be both common and clinically impactful in this age group. This study gave a very clear picture of the prevalence of asthma by identifying the dominant symptoms, patterns of healthcare use, and functional impairment among participants. The highly frequent wheezing, sleep disturbance, school absenteeism, and exercise-related symptoms point to a continuing life burden due to asthma and problems in academic performance on account of the disease.

The overall pattern suggests that a sizeable proportion of school-aged children in Islamabad are living with active or recurrent asthma symptoms that require ongoing management. The findings strongly indicate that the occurrence of asthma in these children is shaped by the interplay of environmental exposures, genetic predispositions, and sociodemographic conditions. Factors such as exposure to household smoke, indoor dampness, dust accumulation, mosquito coil fumes, traffic-related air pollution, and seasonal pollen were commonly reported, demonstrating that children are repeatedly exposed to triggers known to exacerbate respiratory symptoms. Household practices include using either gas or wood for cooking and limited ventilation, adding to indoor air quality problems that may worsen asthma. Genetic reasons were also in the foreground. Many children had a mother or father with asthma, or an affected grandparent; and many had more remote relatives affected with asthma or allergic disorders. Parental consanguinity was also very high, further

reinforcing the evidence for hereditary patterns of influence on the occurrence of asthma. These findings taken together show that the risk of asthma in this population is influenced not just by environmental stresses but is also framed by familial and generational health patterns.

Study also show very strong association of asthma with sociodemographic factors like gender and parents education level which has impact on asthma prevalence. Asthma association with environmental factors shows higher association with smoke, houses and schools located in traffic area and industrial zone that can cause development of asthma. Specific season show strong association in development and triggering of asthma.

Genetic association with childhood asthma shows strong association with parents, grandparents and close family having asthma, and parents being blood related causes major asthmatic problems. Asthma among the population of school-going children in Islamabad is multifactorial, being influenced by the strong interplay between genetics, environment, and sociodemographic context.

These findings lend weight to the need for comprehensive asthma control strategies. Public health initiatives should focus on cutting kids' contact with harmful substances at home or in classrooms, while boosting knowledge for caregivers particularly those facing economic hardship through targeted information campaigns. Instead of waiting, routine checks ought to begin early for young ones whose relatives have asthma or when parents are closely related by blood. Combining these steps helps handle growing cases of childhood asthma in fast-developing cities such as Islamabad. Such a strategy offers clear guidance so officials, teachers, doctors, and households can cooperate effectively. Joint action increases chances for better breathing health in younger populations across urban settings.

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QUESTIONNAIRE

CONCENT

This form is a part of bachelor's level academic research study that assesses the frequency and exploring the risk factors of asthma in school children(5-17 years old)of Islamabad. participation in voluntary, and you may withdrawat any time without consequences. All responses will remain anonymous and confidential and used solely for academic purposes.by starting and completing this form for your children, you(parents) consent to participate and allow the inclusion of your child's data in this study. your cooperation is greatly appreciated!

section A: Sociodemographic Information

Age: _____

Gender:

Male Female

School Type:

Public Private

Residence:

Urban Rural Semi-urban

Number of family members living in the house: _____

Number of siblings (brothers and sisters): _____

Type of Housing:

Rented Owned Shared Other: _____

Number of Rooms in House: _____

Does the child usually sleep in a room alone?

Yes No

average sleeping arrangements:

not shared shared with 1 person shared with 2 persons shared with 3 or more persons

Father's education:

No formal Primary Secondary University or above

Mother's education:

No formal Primary Secondary University or above

Mother's occupation:

Housewife Laborer Skilled worker Teacher/Clerk Professional housewife Other: _____

Father's occupation:

Unemployed Laborer Skilled worker Teacher/Clerk Professional Other: _____

Monthly household income:

Low Middle High

Main source of drinking water:

Tap water Filtered Well Other: _____

Section B: PREVALRNCE OF ASTHMA

Has your child ever had wheezing or whistling in the chest at any time in the past?

Yes No

In the past 12 months, has your child had wheezing, whistling or tightness in the chest?

Yes No

How many attacks of wheezing has your child had in the past 12 months?

None 1–3 4–12 More than 12 none

In the past 12 months, how often has wheezing limited your child’s speech to only one or two words at a time between breaths?

Occasionally rarely Frequently Never

Has your child’s sleep been disturbed due to wheezing in the past 12 months?

Once or more per week Less than once a week Never

Has your child ever been diagnosed with asthma by a doctor?

Yes No

Has your child ever used an inhaler or asthma medication prescribed by a doctor? (e.g., inhaler, nebulizer, medicine)

Yes No

Has your child had a cold or chest infection, in the past 12 months?

Yes No

Has your child had a dry cough at night, apart from a cold or chest infection, in the past 12 months?

No Yes sometimes

In the past 12 months, has coughing, wheezing or breathlessness been a problem when your child is exercising or playing?

Yes No sometimes

Does your child have access to a regular healthcare provider?

Yes No

Where do you usually seek medical care for your child?

Government hospital Private clinic Traditional healer Pharmacy

Other: _____

Has your child missed school due to respiratory illness in the past year?

frequently rarely occasionally never

Does your child have any other allergic conditions?

Hay fever (allergic rhinitis) Eczema (atopic dermatitis) Food allergies None (other: _____)

Has your child ever been hospitalized for wheezing or asthma? If the answer is no then write NO, if yes, how many times in the past 12 months?

no 1 time 2 times 3 times 4 or more times

Section C: Environmental and Genetic Risk Factors

Environmental Factors:

Does anyone in your home smoke cigarettes?

Yes No

Was the mother exposed to smoking during pregnancy?

Yes No sometimes

Type of cooking fuel used at home:

Gas Wood/biomass Coal Other: _____

Do you use a wood-burning stove or an open fire for heating in your home?

Yes No sometimes

Is your kitchen separate from the living/sleeping area?

Yes No

Does your child's bedroom have?

Visible dampness or mold Carpets/rugs heavy curtains Pets (cats/dogs/birds)? none of the above others _____

Is there visible mold, dampness, or water leakage in your home?

Yes No

Do you often keep windows closed at home?

Yes No

Do you use mosquito coils or incense sticks inside your home?

Yes No

Is there a lot of dust in your home?

Yes No

How often does your child eat fast food (e.g., burgers, fries, pizza)?

1-2 times per week 3 or more times per week Rarely never

does your child spend time outdoors in areas with heavy traffic/pollution?

Sometimes Daily Rarely never

Is your home located near heavy traffic, industrial zones, or construction sites?

Yes No

Does your child attend school located in an area with heavy traffic or high pollution?

Yes No

How often does your child play outdoors?

Daily Weekly Rarely

Are there frequent dust storms or high pollen seasons in your area?

Frequently (4 or more) Sometimes (2–3) Rarely (0–1) never

If yes, during which months? _____

Are insecticides or chemical sprays used inside the home? Frequently Occasionally Never never

Do your child's respiratory symptoms worsen during specific seasons? if no then select no, if yes, specify: Spring Summer Autumn Winter others _____

Is your home adequately ventilated during extreme weather (e.g., cold, heat)? Yes No

Does your child use air conditioning or heating devices regularly? if the answer is no then select No If yes, specify type.

No Electric heater Gas heater AC unit

In the past 12 months, has your child's wheezing or coughing been triggered or worsened by any of the following?

Dust Exercise Pollen or seasonal changes Cold air Strong smells (e.g., perfume, cleaning products, paint) Outdoor pollution (e.g., smog, car fumes) None of the above others _____

Genetic / Family History:

Has the child's Mother ever been diagnosed with asthma?

Yes No

Has the child's father ever been diagnosed with asthma?

Yes No

Do any siblings have asthma?

Yes No

Does either parent have a history of asthma or other allergic conditions (e.g., eczema, hay fever)? Yes No, if yes,

specify _____

Do any siblings have allergic conditions? (e.g., eczema, hay fever)

Yes No,

if yes, specify _____

Is there a history of other respiratory, allergic conditions in the family (parents or siblings)? if the answer is no select no, if yes then specify:

No Allergic rhinitis (hay fever) Eczema (atopic dermatitis) bronchitis Food allergies COPD other: _____

Has any grandparent (maternal or paternal) been diagnosed with asthma?

Yes No Don't know

Is there a known family history of genetic disorders or immune system conditions? if the answer is no select no, if yes then specify:

No other: _____

Are the child's parents related by blood (cousin)?

Yes No

Has any close family member (uncle, aunt, cousin) had asthma, eczema, hay fever?

Yes No Don't know

Plagiarism Certificate

This is to certify that the research work "Assessing the frequency and risk factors of asthma in school children of Islamabad, Pakistan" submitted by Hania Irfan, in partial fulfillment of the requirements for the degree of Bachelor of Science in Public Health, is an original piece of work carried out by the student.

I further declare that this research has not been submitted previously to any other university or institution for the award of any degree or diploma. All sources of information used in this research have been properly acknowledged and cited. The similar index of this research work is within the acceptable limit as per university policies.

Sidra Shahid

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