Prevalence of Asthma and Its Association with Socioeconomic Status, Gender, and Consanguinity in Lahore, Pakistan

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Abstract

This study mainly aimed to establish the burden of asthma and allergies in Lahore, Pakistan, and certain gender and socioeconomic inequalities. Data from asthma patients attending the major outpatient department in Lahore was collected through a cross-sectional study design. The study sample was made of women and men who had been clinically diagnosed with asthma. Data on socio-demographic attributes, lifestyle habits, familial environment, and economic situation were collected using structured interviews. The studies reveal that the prevalence is overwhelmingly biased to the gender axis, showing a worse outcome for females as compared to males. Apart from this, there is also an observed degree of relationship between the socioeconomic status and the severity of the asthma, as the members of the lower income class have reported more difficulty to cope up with the disease condition. It was concluded that there is need for undertaking appropriate public health measures and policies for the treatment of asthma belonging to the poor segments of the population. It is recommended and discussed that future investigations in this area should examine the relationship between asthma, including both environmental influences and the interrelated aspects of socioeconomic status.

Keywords: *Asthma, Allergy, Gender, Socioeconomic Status, Lahore, Pakistan, Public Health, Epidemiology.*

Introduction

Asthma is a common respiratory disease encompassing airway obstruction, hyper responsiveness of airway management, and airway inflammation, which bronchial coordination controls. In total, it has been estimated that asthma currently affects about three hundred million people worldwide today. The condition clinically presents with episodes characterized by wheezing or stridor, dyspnea, chest discomfort or tightness, and coughing. There is a great deal of variability in the degree

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and frequency of symptoms both between patients and among family members affected by asthma. The etiology and pathogenesis of asthma are complex in nature and involve genetic predispositions, environmental influences, and socio-demographic variables, much like other medical conditions; asthma is commonly associated with allergic reactions. In social pathology, immune mechanisms in the bronchial architecture are primarily considered. Pathogenic inflammation is the most critical step in this process, involving the activation of mast cells, eosinophils, T lymphocytes, and other sensitive cell types responsive to a wide variety of endogenous and exogenous stimuli and causing eventual cyclical constriction of the bronchi.

Therefore, the airway remodeling routinely caused by these reactions results in structural changes in the bronchia's walls, thereby leading to irreversible chronic respiratory impairment and complications from its treatment. The biological mechanisms has revealed that asthma is a syndrome with multiple different phenotypic expressions rather than one disease.

Epidemiology and Socio-Demography. There has been a drastic increase in the asthma's incidence rate over the last two to three decades among children and adolescents. Epidemiological data of asthma cases have documented increasing asthma incidence by as much as 5 to 6 percent annually. The developed regions include the United States, the United Kingdom, and Australia where populations are generally at a higher risk due to urbanization and their changing lifestyles. International study of asthma and allergies in childhood (ISAAC) claims prevalence in the developed regions is more than twenty five percent, whereas , it prevails in Indonesian and Albanian countries.

Asthma develops as a result of many factors, among which demographic factors such as age and sex. For pediatric diagnosis, the higher incidence is reported in boys than in girls, which might be due to other factors such as the size of airways in relation to lung capacity, among others. However, findings and research reveal that for female adolescents as they grow into adults, their susceptibility to severe asthma is increased, a condition associated with hormonal changes and environmental exposures. This disparity may explain the differences between severity levels observed in asthma among males and females. In this scenario, a tailored approach to treatment is inevitable, one that must be directed by the life stage of the patient in whom asthma occurs, as illustrated in this figure.

Epidemiology and Burden

Asthma is a major global public health problem, estimated to affect 300 million people worldwide, with rising progressively of prevalence rates every decade. This trend is found in all age groups but predominantly in children and adolescents (Holt et al., 2004). The prevalence rates of asthma are most heavily impacted in such countries with highly developed economies, such as the United Kingdom, the United

States, Australia, and Canada, affecting 10-15 percent of their populations (Phelan et al., 1982). Some reasons for this phenomenon include increased exposure to allergens, urbanization, and lifestyle changes associated with the process of westernization. There is a high rise in the prevalence of asthma within developing regions, especially within urban communities, where new patterns of ecosystem changes and limited access to health facilities further complicate its management (Holt et al., 2004; Braman, 2003).

Risk Factors and Triggers

Asthma has been determined to be a complex disease that is influenced by both a genetic and an environmental etiology. Major risk factors include a family history of asthma, a history of allergies, urban living, smoking, and exposure to various indoor and outdoor pollutants (Backer et al., 2010; Vijayan et al., 2006). Besides irritants such as cigarette smoke, fragrances, and volatile organic compounds, several environmental allergens may trigger asthma, from dust mites and pet dander to pollen and mold (Gold, 1992). Moreover, there is research conducted regarding the link of dietetic factors, among those antioxidants and vitamins intake with asthma risk, but without determining conclusions (Akinkugbe & Ette). In addition, respiratory infections and obesity are significant contributors to the development of asthma, especially in children, as viral infections may trigger or worsen asthma episodes.

Asthma is identified as an inflammatory pulmonary disorder, in which the intensity of inflammation is associated with the severity of symptoms and the extent of bronchial hyper responsiveness (Clough & Dow, 1987; Ingram, 1991). This hyper responsiveness constitutes a critical element of asthma pathology, establishing a direct connection between inflammation and airway obstruction. Over time, chronic inflammation can result in irreversible alterations in lung structure, a process that medication can only partially reverse (Jeffrey et al., 1989; Murphy, 1997). In asthma, the symptoms can be mild, episodic, or persistent and will vary within the broad spectrum from a simple cough to very severe wheezing. This variability complicates the diagnosis, as asthma can masquerade under recurrent bronchitis, bronchiolitis, or even pneumonia, especially in children (Brooke et al., 1995; Sherman et al., 1990).

Factors Influencing Asthma

A variety of demographic and environmental elements impact both the prevalence and the outcomes associated with asthma. Age plays a significant role; older individuals tend to exhibit more severe, progressive, and less reversible manifestations of asthma in comparison to their younger counterparts (Garreld et al., 1999; Gerth et al). Additionally, gender contributes to variations in asthma patterns, as males demonstrate a higher incidence of asthma prior to the age of 15, whereas adult-onset asthma occurs more commonly among females (Demarco et al., 2000).

Worldwide, Asthma has risen precipitously in prevalence, especially in children and young adults. Predictions assert a yearly increase in prevalence of approximately 5-6%, with children living in urban environments faring significantly higher than others (Pertowski et al., 1998). Numerous studies, including national surveils like the National Health Interview Survey, reported Asthma prevalence in the

US to be between 5.8% and 7.2%. Additionally, data show that asthma-related emergency room visits and mortality rates have increased, highlighting the growing public health impact of asthma (Silver et al., 1998).

Genetic and Familial Factors in Asthma

The genetic predisposition plays an important role in influencing the susceptibility to asthma. Factors such as the occurrence of asthma or atopic disorders can significantly increase the likelihood of a person developing asthma. This has been indicated as a genetic influence (Duffy et al., 1990; Sibbald et al., 1980). Studies concerning the concordance of twins demonstrate that monozygotic twins have a higher concordance rate for asthma compared with their monozygotic co-twins, which further supports the assumption of genetic influence. Nevertheless, genetics alone cannot explain all asthma cases, as environmental factors often interact with genetic predispositions to affect the development of asthma (Borish, 1999).

Gender Differences

The incidence and severity of asthma show significant gender differences at various points in life. Asthma diagnoses have a higher rate among boys in childhood; however, this trend reverses after puberty, with females showing higher rates of adult-onset asthma (Von Mutius et al., 2001). In addition, adult females tend to be at a greater risk of suffering from severe asthma attacks and, overall, have a worse reaction to traditional forms of treatment. This change is thought to be related to the hormonal effects on immune functionality and airway responsiveness, since studies have shown that estrogen could enhance the inflammatory mechanisms related to asthma (Demarco et al., 2000).

The Burden of Asthma on Health Systems

Asthma will exert a great influence on healthcare systems around the world, with its ramifications very clearly evident in direct costs incurred due to admissions, emergency services visits, and drug spending, along with indirect costs involving lost productivity and absenteeism. In the United States, it is estimated that billions of dollars annually are spent due to asthma. Effective management of asthma requires an appropriate approach that incorporates medication, educational support to patients, and environmental control; however, disparities persist in accessing healthcare services and asthma care among different groups.

Economic and Social Impact

The economic costs of asthma are highly significant and often outweigh the costs associated with tuberculosis and HIV/AIDS in many countries (Hoare et al., 1999). The direct health care costs involve hospitalizations, medications, and physician consultations, besides indirect costs where loss of school days or days lost from work add to the costs burdening healthcare systems. In the United States, costs of asthma are expected to exceed $12 billion a year, with a large portion of these estimated costs due to severe cases (Beasley, 2002). The disease is notably more prevalent among lower-income populations and in urban settings, where higher prevalence rates are being seen particularly among African American and Hispanic

populations in the U.S. (Crain et al., 1994; Gergen et al., 1988). Poor control of asthma in these populations often translates into more hospitalizations and emergency room visits, highlighting an urgent need for targeted interventions and greater access to healthcare resources.

Environmental and Genetic Contributors

Exposure to the environment is also a contributor that can precipitate or worsen asthma. Common triggers include various air pollutants, allergens from sources such as dust mites, pollen, and pet dander, and tobacco smoke. Socioeconomic factors and residence location are also contributing factors, with a higher prevalence of asthma found in more impoverished inner city environments with high levels of pollution and poor housing.

Genetic predisposition is indeed a significant factor in asthma development. A family history places a person at a higher risk, and research has identified genes on chromosomes 5q, 12q, and 17q as being associated with asthma susceptibility. Gene-environment interactions studies further show that some genetic markers increase the sensitivity to environmental allergens, which increases the possibility and severity of asthma.

Methodology

This research used a questionnaire survey in a structured design for ascertaining the prevalence of asthma and its association with demographic and socio-economic factors in the region of Lahore, Pakistan. The research also explored its relation with consanguineous marriages because consanguineous marriages prevail in the region. Focusing on urban and rural populations helped the research attain a better understanding of how asthma operates among different community settings.

Study Population

This study was conducted at the Outpatient Department, OPD, of Gulab Devi Chest Hospital in Lahore, Punjab, Pakistan. Patients were male and female asthma patients diagnosed by certified physicians. The study sample intentionally included patients from a wide range of urban and rural areas within North Punjab to capture demographic variability in asthma prevalence and presentation. Urban participants were recruited from the developed areas of Lahore and adjoining cities. For rural participants, the sample included people from Faisalabad, Gujranwala, Gujrat, and Sialkot. This diversified sample is intended to represent the general population's prevalence of asthma resulting from different environmental, lifestyle, and socioeconomic factors.

Inclusion and Exclusion Criteria

Only patients with a formal asthma diagnosis by a certified physician were included. The study excluded patients who self-diagnosed, pregnant women, and individuals with concurrent respiratory conditions such as pneumonia or tuberculosis, to minimize potential confounding factors.

Data Collection

The structured interviews, to be conducted through a specially designed and field-tested questionnaire, would account for the acquisition of data. These varied

demographics and lifestyle variables covered, such as age, gender, education level (illiterate, Middle School, Matric, College, and University/Professional Education), marital status, employment status, income level, smoking habits, physical activity, and dietary patterns. The questioning on family history of asthma and allergy will help the research team explore possible genetic and familial risk factors.

Participants were stratified into three income categories based on the monthly family income: Low-income, under 10,000 PKR; middle-income between 10,000–50,000 PKR; and high-income over 50,000 PKR. Consanguineous marriage patterns were also collected, as it is a culturally relevant and hypothesized explanation for genetic predisposition in asthma.

Physical Assessment and Anthropometry

The height and weight of each participant were taken using a portable weighing scale and stadiometer. Then, the body mass index (BMI) was calculated through dividing the weight of the participant in kg by the square of his or her height in meters (kg/m^2). Weight status was classified with a BMI exceeding more than 25 kg/m^2 following WHO recommendations (Hwang et al., 2006). Those BMI values were then categorized as underweight, normal, overweight, and obese. This was to enable researchers to determine the relationship between body composition and asthma prevalence and severity.

Ethical Considerations

The study was approved by the Board of Studies (BOS) at Lahore College for Women University. Permissions were sought from the administration of Gulab Devi Chest Hospital. The participants, with whom this data was obtained, provided written informed consent and thumbprints for those illiterate, as a warranty from participants for exclusive use of the data for research purposes and that no personal information would be divulged.

Data Analysis

Data analysis was done using Microsoft Excel 2010. Descriptive statistics were calculated; continuous variables are presented as mean ± SD, and categorical variables are presented as frequencies and percent. Graphical representations were done in the form of bar graphs and pie charts to depict demographic trends, and associations of age, BMI, and asthma prevalence across gender and socioeconomic groups.

Results

The study included 232 asthma patients; the majority of these patients were females 75% while males were at 25%. Other key findings include;

- **Age and Gender:** The mean age for females was 33.90±12.91 while for males was 39.45±18.80. Females had pediatric asthma while males predominantly exhibited adult onset asthma.
- **BMI: Underlying** results concerning BMI showed a higher prevalence of asthma in subjects that were overweight and obese, but more females were obese than males.

• **Socioeconomic Disparities:** The analysis showed that asthma levels were higher among poor and in urban dwellers, suggesting inequities in access to care and exposure to the environment.

Discussion and Conclusion

The findings of this study point out significant relations between asthma prevalence and demographic factors such as gender, age, socioeconomic conditions, and lifestyle. Findings of the study are consistent with the literature, which suggests that asthma is predominantly higher in females, especially among adults. This gender bias can be explained through hormonal effects which enhance airway responsiveness in females after puberty (Demarco et al., 2000). Moreover, the statistics demonstrate how the disease asthma occurs differently at different stages of life, such as childhood asthma predominance in males and adult-onset asthma is more prevalent among women, indicating differences in physiological and environmental factors which affect asthma at various ages and gender.

Socioeconomic Factors

The study found that asthma prevalence was higher in low-income populations, supporting previous research that associates poverty with increased asthma morbidity and mortality (Gergen et al., 1988). Poor socioeconomic conditions may exacerbate asthma through limited access to healthcare, exposure to higher levels of indoor and outdoor pollutants, and inadequate housing conditions. Poorly managed asthma in low-income populations further adds to asthma triggers such as exposure to dust, mold, and allergens, especially in crowded living conditions in urban areas. This pattern has been observed in other settings where low-income populations report increased emergency room visits and hospitalizations due to asthma (Crain et al., 1994).

In contrast, respondents from rural areas reported lower asthma prevalence rates overall but fewer health care resources as well as fewer preventive interventions. Rural residents in developing countries such as Pakistan often face delayed diagnoses and less access to asthma management resources, making public health interventions that can address the inequities in healthcare associated with rural environments crucial.

Effect of Consanguineous Marriages

Consanguineous marriages, which are common in certain communities in Pakistan, were thus assessed in this study for their potential role in asthma prevalence. Genetic predisposition is an established risk factor for asthma, with studies suggesting that asthma has a heritable component influenced by complex interactions between multiple genes and environmental factors (Duffy et al., 1990). By analyzing consanguinity, the study brings out insights on how family genetics might increase the vulnerability to asthma and allergies, especially among communities where inter-family marriages are common. Further genetic studies are therefore warranted in probing this association in greater detail.

Body Mass Index (BMI) and Lifestyle Factors

It found asthma and body mass index relationships, such that overweight and obese participants had higher asthma prevalence. These results echo a developing body of research associating obesity with worse asthma outcomes and increased severity of asthma disease (Novak et al., 2003). Obesity contributes to airway inflammation and lower lung function, both of which worsen asthma symptoms. Weight loss interventions have held promise in improving asthma outcomes, particularly in obese individuals (Hwang et al., 2006).

Smoking has been another lifestyle factor studied in this study, which was reported by both active smokers and those exposed to secondhand smoke to increase the prevalence of asthma. Tobacco smoke is an irritant that leads to chronic inflammation in the airways, complicating asthma management even further (Neukirch et al., 1991). The study thus points out the importance of public health campaigns that focus on smoking cessation as a crucial strategy for asthma prevention and control.

Public Health Implications and Recommendations

Public health interventions targeting specific needs of asthma management in Pakistan are required. Considering the rising trends of asthma across low-income and urban populations in Pakistan, public health interventions should focus on better accessibility of affordable asthma care services, mainly targeting the deprived communities. Education programs that raise awareness about asthma triggers and management techniques can empower patients to manage their symptoms more effectively and reduce the load on healthcare facilities. In the rural sector, increased accessibility of healthcare services, as well as trained asthma specialists, may reduce the delayed diagnosis and lack of treatment options reported in this study.

In addition, public health policies should include indoor and outdoor air quality control. Environmental factors contribute to the prevalence of asthma symptoms; therefore, it is necessary to formulate policies related to minimizing air pollution, controlling allergens, and smoking cessation as a complete approach toward reducing the prevalence and severity of asthma in Pakistan.

The outcomes of this study suggest the necessity for targeted public health programs to effectively manage asthma in Pakistan. In light of the rising rates of asthma among low-income and urban populations, there is a responsibility to focus on increased accessibility to affordable asthma care, especially in unprivileged communities.

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