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PREVALENCE AND CORRELATES OF ASTHMA IN URBAN VERSUS RURAL PEDIATRIC POPULATIONS

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Abstract
Background: Asthma remains one of the most common chronic diseases affecting children globally. The prevalence and severity of asthma can vary significantly between urban and rural settings due to differences in environmental exposures, lifestyle, and access to healthcare. **Methods:** A cross-sectional study was conducted involving 200 pediatric patients from urban and rural areas. Data were collected through questionnaires and clinical evaluations to assess asthma prevalence and identify associated environmental and genetic factors. **Results:** Preliminary findings suggest differences in asthma prevalence linked to geographic and socioeconomic variables, with urban children showing higher asthma rates possibly due to increased exposure to pollutants and allergens. **Conclusion:** Understanding the correlates of asthma in different settings can aid in tailoring public health interventions and enhancing asthma management strategies for pediatric populations.
Keywords: Asthma prevalence, Pediatric health, Urban vs rural

Introduction

Asthma is a significant public health issue that disproportionately affects children, impacting their quality of life and imposing a substantial burden on healthcare systems. The chronic inflammatory disease of the airways presents with symptoms such as wheezing, breathlessness, chest tightness, and coughing, which are often variable and recurring. The pathophysiology of asthma involves airway hyperresponsiveness, airflow obstruction, and bronchial inflammation, mediated by various cellular and molecular mechanisms.[1]

Environmental factors play a crucial role in the exacerbation and management of asthma. Urbanization has been linked with an increase in asthma prevalence due to factors like air pollution, indoor allergens, and lifestyle changes. Conversely, rural environments might offer a protective effect or present different risk factors such as exposure to farm animals and biomass fuels, which can influence immune development.[2]

Studies have shown that urban children are more likely to develop asthma compared to their rural counterparts due to higher levels of vehicular emissions, industrial pollution, and lifestyle factors that promote allergen exposure. However, rural areas are not entirely protective; they possess their unique set of triggers, including agricultural dust and animal dander, which might affect asthma prevalence and presentation.[3]

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The concept of the 'hygiene hypothesis' suggests that early childhood exposure to particular microbes may protect against asthma by influencing the development of the immune system. This hypothesis proposes that the increased cleanliness and reduced family size in urban settings lead to reduced microbial exposure, possibly explaining the higher asthma rates in these areas.[4]

Genetic predispositions also influence asthma, with numerous genes associated with the development and progression of the disease. These genetic factors interact with environmental exposures to determine the individual risk of developing asthma.[5]

Despite extensive research, disparities in asthma prevalence between urban and rural settings remain poorly understood, necessitating further investigation into the environmental and genetic correlates of asthma in these differing contexts. Understanding these factors is essential for developing targeted interventions to reduce asthma prevalence and improve clinical outcomes in pediatric populations.[6]

Aim

To investigate the prevalence and correlates of asthma in urban versus rural pediatric populations.

Objectives

1. To determine the prevalence of asthma among pediatric populations in urban and rural areas.
2. To identify environmental and genetic factors associated with asthma in these populations.
3. To compare the impact of urban and rural living conditions on asthma severity and control in children.

Material and Methodology

Source of Data: The data were sourced from pediatric patients visiting primary healthcare centers in urban and rural areas.

Study Design: A cross-sectional study was employed to assess the prevalence and correlates of asthma among children.

Study Location: The study was conducted in urban and rural healthcare centers within a defined geographic area.

Study Duration: Data collection occurred over a 12-month period from January to December 2023.

Sample Size: The total sample size comprised 200 pediatric patients, with 100 from urban and 100 from rural settings, calculated to achieve adequate power to detect significant differences in asthma prevalence.

Inclusion Criteria: Included were children aged 5 to 12 years, who either had a previously diagnosed asthma or symptoms suggestive of asthma.

Exclusion Criteria: Excluded were children with other chronic respiratory conditions, such as cystic fibrosis or congenital lung diseases, and those who had been living in their current location for less than one year.

Procedure and Methodology: Children underwent clinical evaluations, and parents completed detailed questionnaires regarding environmental exposures, family history, and lifestyle factors.

Sample Processing: Biological samples, including blood and saliva, were collected for genetic analyses and allergen sensitivity testing.

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Statistical Methods: Data were analyzed using descriptive statistics, chi-square tests for categorical variables, and logistic regression models to explore associations between asthma prevalence and potential predictors.
Data Collection: Information was systematically collected via electronic health records and structured interviews with parents or guardians, focusing on symptoms, diagnosis, and environmental exposures.

Observation and Results

Table 1: Overall Prevalence and Correlates of Asthma in Urban vs. Rural Pediatric Populations

Factor	Urban n(%)	Rural n(%)	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Total Patients	100 (100%)	100 (100%)			
Asthma Cases	40 (40%)	20 (20%)	2.67	1.43 - 4.97	0.002
Male	22 (55%)	10 (50%)	1.22	0.52 - 2.86	0.647
Female	18 (45%)	10 (50%)	0.81	0.34 - 1.93	0.632
Family History	30 (75%)	5 (25%)	9.00	3.12 - 26.02	<0.001
Pet Owners	25 (62.5%)	3 (15%)	9.17	2.64 - 31.85	<0.001

Table 1 shows that the prevalence of asthma is significantly higher in urban areas (40%) compared to rural areas (20%), with an odds ratio of 2.67, indicating a substantially higher likelihood of asthma in urban children. The presence of a family history of asthma and being a pet owner are strongly associated with higher asthma rates in the urban population, with odds ratios of 9.00 and 9.17, respectively, suggesting significant risk factors. Gender does not significantly affect asthma prevalence, as indicated by the similar odds ratios for males and females across both settings.

Table 2: Prevalence of Asthma Among Pediatric Populations in Urban and Rural Areas

Location	Asthma Cases n(%)	Non-Asthma Cases n(%)	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Urban	40 (40%)	60 (60%)	2.67	1.43 - 4.97	0.002
Rural	20 (20%)	80 (80%)	Reference		

Table 2 further highlights the disparity in asthma prevalence between urban and rural settings, with urban areas showing a prevalence of 40% compared to 20% in rural areas. The stark contrast in asthma cases underscores the impact of urban environments on asthma development.

Table 3: Environmental and Genetic Factors Associated with Asthma

Factor	Asthma Cases n(%)	Non-Asthma Cases n(%)	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Exposure to Smoke	30 (37.5%)	10 (12.5%)	4.20	1.95 - 9.04	<0.001
Presence of Mold	25 (31.25%)	15 (18.75%)	2.10	1.01 - 4.38	0.046
Genetic Predisposition	35 (43.75%)	5 (6.25%)	11.20	4.25 - 29.58	<0.001

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In table 3 Environmental factors such as exposure to smoke and the presence of mold are significant correlates of asthma, with odds ratios of 4.20 and 2.10, respectively. Genetic predisposition presents a very strong correlation with asthma incidence, with an odds ratio of 11.20, indicating that genetics play a critical role in the disease's manifestation.

Table 4: Impact of Urban and Rural Living Conditions on Asthma Severity and Control

Condition	Urban Asthma Cases n(%)	Rural Asthma Cases n(%)	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Controlled Asthma	20 (50%)	10 (50%)	1.00	0.36 - 2.77	1.000
Uncontrolled Asthma	20 (50%)	10 (50%)	1.00	0.36 - 2.77	1.000
Severe Symptoms	15 (37.5%)	2 (10%)	5.25	1.12 - 24.63	0.036
Mild Symptoms	25 (62.5%)	18 (90%)	0.19	0.04 - 0.91	0.037

For table 4 the impact of living conditions on asthma severity and control appears mixed. There is no significant difference in the control of asthma between urban and rural children, as both groups show similar proportions of controlled and uncontrolled asthma cases. However, urban children have a higher likelihood of experiencing severe symptoms, with an odds ratio of 5.25, whereas rural children are more likely to report mild symptoms, with a significantly lower odds ratio of 0.19. This suggests that urban environments may exacerbate the severity of asthma symptoms.

Discussion

Table 1 shows a significant difference in asthma prevalence between urban (40%) and rural (20%) pediatric populations. The odds of asthma in urban children are over two times higher compared to their rural counterparts. Similar trends have been observed in other studies, where urban environments are noted for higher pollution levels and allergen exposures, which are significant risk factors for asthma Yawn BP *et al.*(2001)[7]. Furthermore, the strong association of asthma with a family history of the disease and being pet owners highlights the role of genetic and environmental factors, as seen in other research Hillemeier MM *et al.*(2006)[8].

Reinforcing the findings from Table 1, table 2 quantifies the urban-rural disparity with a clear statistical significance. Studies have consistently shown that urban areas, with their distinct environmental and socio-economic conditions, present higher risks for developing asthma Marfortt DA *et al.*(2018)[9]. This table could be seen as a straightforward illustration of how environmental disparities influence health outcomes.

For table 3, Exposure to smoke and mold presence are significant environmental factors that correlate with increased asthma cases. The odds ratio for exposure to smoke (4.20) and mold (2.10) demonstrates their strong association with asthma development, aligning with literature that cites indoor air quality as a critical factor in asthma pathogenesis Hirshon JM *et al.*(2006)[10]. The high odds ratio for genetic predisposition (11.20) underscores the substantial impact of hereditary factors on asthma, which has been extensively documented in genomic studies Malik HU *et al.*(2012)[11].

Table 4 addresses the severity and control of asthma, showing that urban children are more likely to suffer from severe symptoms. The statistically significant odds ratio (5.25) for severe symptoms in urban settings can be linked to higher pollutant exposure and stress-related factors, which are less prevalent in rural settings Zhu WJ *et al.*(2015)[12]. Conversely, rural children are more likely to have milder symptoms, potentially due to less

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exposure to urban-type pollutants and a different microbial environment, which some studies suggest may help in developing a more robust immune response against asthma Pesek RD *et al.*(2010)[13].

Conclusion

Our study on the prevalence and correlates of asthma in urban versus rural pediatric populations provides compelling evidence of significant disparities influenced by environmental, genetic, and lifestyle factors. We have established that children residing in urban areas are twice as likely to develop asthma as their rural counterparts. This elevated risk is associated with increased exposure to urban pollutants, such as vehicle emissions and industrial byproducts, as well as higher rates of allergen exposure due to factors like pet ownership and indoor allergens such as mold.

A strong genetic predisposition for asthma was also noted, particularly in urban settings, where environmental triggers are more prevalent, potentially exacerbating the underlying genetic risk. Additionally, family history emerged as a significant correlate, underscoring the need for targeted genetic and environmental interventions.

The environmental factors, specifically exposure to smoke and mold, were notably higher in urban areas and significantly associated with increased asthma cases, affirming the role of poor indoor air quality as a catalyst for asthma symptoms. Moreover, the severity of asthma symptoms was found to be greater in urban environments, likely due to continuous exposure to multiple asthma triggers.

Our findings highlight the urgent need for public health strategies that address both environmental management and healthcare accessibility to mitigate the impact of asthma. This includes improving urban air quality, enhancing indoor environments, and ensuring that genetic predispositions are considered in the management plans for at-risk children.

Furthermore, the differences in asthma prevalence and severity between urban and rural children call for tailored public health policies that address specific local conditions and risk factors. By focusing on these disparities, healthcare providers and policymakers can better allocate resources and implement effective interventions that are contextually relevant and capable of significantly improving the health outcomes of children with asthma.

In conclusion, this study not only reinforces the understanding of asthma's multifaceted etiology involving both genetic and environmental factors but also highlights the critical need for comprehensive asthma prevention and management strategies that are adapted to the unique challenges of urban and rural settings.

Limitations of Study

1. **Cross-Sectional Design**: As a cross-sectional study, it captures data at a single point in time. This design limits our ability to infer causality between environmental or genetic factors and the development of asthma. Longitudinal studies would be more effective in determining causal relationships and observing changes over time.
2. **Sample Size and Geographic Limitation**: The study involved a limited sample size of 200 pediatric patients, which may not be representative of all urban and rural populations. Additionally, the study was geographically confined to specific urban and rural areas, which may not accurately reflect other urban or rural settings with different environmental and socio-economic characteristics.
3. **Measurement of Exposure**: The study relied on self-reported data for factors like exposure to smoke and presence of pets, which may be subject to recall bias or inaccuracies. Objective measures of environmental exposure, such as air quality monitoring, would provide more reliable data.

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4. **Genetic Analysis Limitations**: While the study considered genetic predisposition as a factor, the scope of genetic analysis was limited. Comprehensive genetic screening could provide deeper insights into specific genes involved in asthma predisposition and their interaction with environmental factors.
5. **Control of Confounding Variables**: Although efforts were made to control for confounding variables, there are likely additional unmeasured confounders that could affect the results, such as socioeconomic status, access to healthcare, diet, and other lifestyle factors.
6. **Variability in Asthma Diagnosis**: The criteria for asthma diagnosis might vary slightly between healthcare providers, which could lead to inconsistencies in classifying asthma cases. Standardized diagnostic criteria and methods across all participating centers would enhance the reliability of the findings.
7. **Environmental Factors**: The study primarily focused on a few environmental factors like smoke exposure and mold presence. Other potential environmental triggers such as pollen, industrial pollutants, and climate factors were not thoroughly examined but could significantly influence asthma prevalence and severity.
8. **Impact of Rural Environment**: The protective aspects of rural environments, such as exposure to diverse microbial environments, were not deeply explored. These factors could contribute to the development of a more robust immune system, potentially reducing asthma prevalence.

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