

Published: July 31, 2022

Citation: Sultana R, Ghani M, et al., 2022. Factors Influencing the Asthma Control among Children, Medical Research Archives, [online] 10(8).
<https://doi.org/10.18103/mra.v10i7.2942>

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DOI
<https://doi.org/10.18103/mra.v10i7.2942>

ISSN: 2375-1924

REVIEW ARTICLE

Factors Influencing the Asthma Control among Children

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Author Contributions

1. **Razia Sultana** designed the study, collected data and prepared manuscript. This work was conducted as a part of Razia Sultana's thesis towards a Master degree in Nursing, University of Health Sciences Lahore, Pakistan.
2. **Mansoor Ghani** helped in analysing the data and processing the study towards its completion.
3. **Barbara Ann Smith** proof reading or revising it critically for important intellectual content and final approval for the submitted version.
4. **Shazia Ashraf** helped in discussion.
5. **Shakeela Bashir** helped in references writing.

ABSTRACT

Background: Bronchial sensitive individuals are prone to develop many health issues from airborne allergens, and viral and bacterial respiratory infections. Studies have shown that airborne allergen causes allergies and asthma in the susceptible population. Some other environmental factors such as tobacco smoke, air pollution and diet have also been linked to an increased risk for the onset of asthma. The burden of asthma is increasing day by day but the exact etiology of asthma is yet unknown. Some genetic predisposition and environmental factors are thought to play a role in causation of disease, yet how they interact to cause asthma it is still being investigated.

Methods & Study Design: A Cross- sectional analytical study design was used to determine the various environmental factors that can trigger asthma and their association with asthma control among school aged asthmatic children, 4-12 years age. A questionnaire was used to find out various environmental factors that can trigger asthma attacks. Data was represented in the form of tables and the chi square test was used to determine the association of various environmental factors with asthma control.

Results: A total of 196 asthmatic children and their parents participated in this study. The chi-square test showed that female parents control asthma more effectively as compared to male parents. The majority of parents 118 (60.2%) were living in urban areas, 180 (91.8%) parents had low income adequacy level, 119 (60.7%) parents' homes had 1-2 rooms, and 118 (60.2%) homes were congested/poor ventilated. Environmental factors had a direct link with asthma. Children exposure to passive-smoking 106 (54.08%), exercise ($p = .035^*$), sports ($p = .015^*$), cold weather ($p = .002^*$), seasonal allergy ($p = .002^*$), allergic rhinitis ($p = .004^*$), small homes ($p = .008^*$) and, uneducated parents (no education or primary only) ($p = .035^*$) are factors that are associated with high asthma rates.

Conclusion: Asthma is influenced by environmental factors. By modifying environmental factors, we can improve the number of asthma episodes among asthmatic children.

Keywords: Asthma, Control, Environmental Factors, Children

Introduction

Childhood asthma is the most common non-communicable respiratory disorder and it causes a great burden on health and healthcare systems¹. The prevalence, morbidity and mortality related to childhood asthma among children has increased worldwide over the last 4 decades². Approximately 334 million people globally suffer from asthma and we are expected to add 100 million more by the year 2025. An estimated worldwide asthma mortality is reported as 180,000 per year³. Many international studies have shown that the prevalence of asthma and allergies have increased significantly over the last few decades, especially among children⁴. Allergic respiratory diseases are equally common among developed and developing countries. Asthma prevalence has a large variation ranging from 4.1% to 32.1% among children in the age group of 6-7 years over the world³. In the USA prevalence of asthma was found 12.1% and a higher prevalence 13.1% was reported in England⁵. The prevalence of asthma in the same age group was also reported from other countries such as Qatar 19.8%, Tonga 12.5%, Fiji 13.6%, Cape Town 20.3%, Hong Kong 11%, UK 20.9%, and India 15%³ and, in Bangladesh the prevalence was 9.1% reported⁵.

Pakistan is the sixth most populous and economically developing country. Thus, its population has the greater chances of developing asthma and allergic diseases³. The Global Initiative for Asthma (GINA) documented the prevalence of asthma in Pakistan is 4-5%⁶. Several epidemiological studies in Pakistan reported a great difference in asthma prevalence ranging from 4.3% to 31.58% in different regions. Approximately, 20% of the overall pediatric population of Pakistan has been affected by asthma³. One study conducted in Karachi reported the estimated occurrence of doctor-identified asthma was 15% in school-aged children ages 3-16 years⁴. Another asthma report about school-aged children in Islamabad indicated that the prevalence of asthma is 31.58%³.

Several studies indicated the burden of asthma is increasing day by day but the exact etiology of asthma is yet unknown⁵, although some genetic predisposition and environmental factors are thought to play a role in causation of disease how they interact to cause asthma is still being investigated^{7,8}. Environmental factors involved in predisposition of asthma are airborne allergens and viral respiratory infections^{9, 10, 11}. Some other environmental factors such as tobacco smoke, diet, air pollution have also been linked with an

increased risk for the onset of asthma.^{12, 13} Environment can trigger the onset or exacerbation of asthma, therefore controlling environmental factors along with medication should be the part of treatment of asthmatic children¹⁴. Several studies have demonstrated that air pollution has direct correlation with asthma and this correlation was found to be stronger as compared to association of food allergens with asthma¹⁵. In utero life exposure to environmental smoke has been shown to increase the chance for wheezing in the infant and subsequent development of asthma¹⁶. A study done by McConnell et al exhibits that outdoor heavy exercise with high concentration of ozone was associated with a greater risk of asthma among school age children¹⁷. Mostly the asthmatic child carries a history of atopy (refers to the heredity tendency to develop allergic diseases such as dermatitis, eczema, allergic rhinitis, food allergy, and weather changes / aeroallergens sensitization). If a family has a history of asthma then it strongly supports the diagnosis in children.¹⁸

Despite the advancement in the field of medicine, more and more people are suffering from asthma⁵ which may be because we have not identified all the potential triggers and are lacking effective methods to manage them.

Pakistan is not an exception like other developing countries from the alarming situation of allergic respiratory diseases³. Unfortunately, in Pakistan there are scarce studies that attempt to explore the risk factors for asthma in populations of children aged 4-12 years. A study conducted in Mardan to identify some main risk factors associated with asthma, included 224(67%) children's father were smokers, and 221 (68%) children's rooms were carpeted⁴. Another study conducted at Karachi reported some more asthma factors including homes with ill-ventilated kitchens (Adjusted OR: 1.8, 95% CI: 1.1–3.1), and the family history of asthma (Adjusted OR: 2.3, 95% CI: 1.3–3.9)¹⁹. Moreover, another study conducted at Karachi, reported some additional factors associated with asthma in children such as exposure to passive smoking (OR: 3.6; 95% confidence interval: 2.3- 5.8), residing in mud homes (OR: 16.2; 95% confidence interval: 3.8-69.5), congested rooms without windows (OR: 9.3; 95% confidence interval: 2.1-40.9) and living homes without adequate sunlight (OR: 1.6; 95% confidence interval: 1.2-2.4).⁵

The identification of risk factors is crucial for the adaptation of preventive measures and keeps asthma well- controlled among children. Well-controlled asthma is correlated with improved health quality, a decrease in physician visits, the

number of hospitalizations and emergency room visits among both asthmatic children and adults²⁰. Whereas, uncontrolled asthma is directly correlated with poor health status, and it greatly affects children daily activities, reduce emotional well-being, increase school absenteeism and decrease work productivity among asthmatic children as well as parents/ guardians; respectively.²¹

Methodology

A cross sectional study was conducted at two tertiary care hospitals Shaikh Zayed Hospital Lahore and the Children's Hospital & the Institute of Child Health, Lahore in Punjab Province. Ethical approval for this study was granted by the Ethical Review Committee for Medical and Biomedical Research 30-07-2013, University of Health sciences Lahore, Pakistan. The duration of this study was one year from 01-08-2013 to 01-07-2014.

The sample size was decided on the basis of a previous study²². According to WHO guidelines, when the objective of our research is to estimate the percentage outcome variable) then we will use sample size formula for estimation of population proportion that is given below;

$$n = \frac{Z^2_{1-\alpha/2} P (1 - P)}{d^2}$$

(Sample Size determination in health studies version 2.0.21 WHO)

The sample size was calculated keeping the confidence level equal to 95% and the margin of error equal to 7%.

$Z^2_{1-\alpha/2}$ = for 95% confidence level = 1.96

P = Anticipated Proportion of Adequate Knowledge²² = 53.2%

d = Margin of error = 7%

n = Sample Size = 196

A total of 196 asthmatic children aged 4-12 years with their parents, who came for follow-up in asthmatic clinics of the selected hospitals were included in this study. Newly diagnosed asthmatic children were not entertained in this study. Non-probability purposive sampling was executed for data collection. Inclusion criteria includes, all the cases were children between 4-12 years of age with their parents/ guardians, who had a history of

recurrent episodes of wheezing (> 3 times), and at least two episodes of recurrent wheeze in the preceding 6 months treated with bronchodilators. The children who are on aerosol therapy and who have had at least two emergency room visits or one hospitalization in the previous 6 months. Children with chronic illness such as bronchiectasis, tuberculosis, cardiac diseases and cystic fibrosis were excluded from this study.

Most of the study sample was collected from the Children's Hospital & the Institute of Child Health, Lahore. The researcher developed rapport the child and parent, informs them about the study, ensures their willingness and consent was taken from the participants. Children were recruited according to inclusion criteria. Eligible children with their parents who had given informed consent, the researcher started the interview in a quite separate, comfortable setting within the asthma clinic. The questionnaire was completed by the researcher. The questionnaire had been translated into Urdu language for best understanding and queries were explained in a kind manner. Upon completion, the questionnaire was inspected to ensure that participants answered all the subsections of the questionnaire.

A questionnaire was used to find out various environmental factors that can trigger asthma attacks. The questionnaire was composed of demographic data (asthmatic child profile, parents/ guardian profile, and environmental profile), and the factors that can cause an asthma attack. It was developed with the help of literature review^{23, 24, 25}.

Further detail to assess the parent's knowledge about asthma and asthma control in children, questionnaires are available in this published study²⁶. The collected data was analysed by using SPSS version 20. Descriptive statistics were measured as frequencies, percentages, mean and standard deviation. The chi square test was executed on cross tables among demographic and, trigger factors with different groups of asthma control. The parent's educational level was also assessed with asthma knowledge. A p-value ≤ 0.05 was considered as a positive correlation among two cross tabulated factors.

Results

Table 1: Presenting the demographic data

a) Asthmatic Child Profile		%
Gender		
Male	119	60.7
Female	77	39.3
AGE (Years) Mean \pm SD	8.94 \pm 2.48	
Child age at Diagnosis (Years) Mean \pm SD	5.77 \pm 2.59	
Comorbid Allergic Conditions	YES n (%)	NO n (%)
Allergic rhinitis	47 (24.0)	149 (76.0)
Seasonal allergy	179 (91.3)	17 (8.7)
Food allergy	190 (96.9)	06 (3.1)
Other allergic conditions	05 (2.6)	191 (97.4)
ED/ Asthma clinic visits: Past six month		
< 7	108	55.1
7-8	80	40.8
> 8	08	4.1
Any hospitalizations: Past six month (% Yes)	25 (12.8)	171(87.2)
If yes, how many times.(1-2 times, None)	25 (12.8)	171(87.2)
Family Members w/Asthma		
If (Yes) who is?	90	45.9
Grandparents	62	31.6
Sibling	05	2.6
Parents	09	4.6
Close relatives	14	7.1
b) Parents/ Guardian Profile		%
Gender		
Male	53	27.0
Female	143	73.0
AGE (Years) Mean \pm SD	36.34 \pm 7.30	
Relation. Child		
Mother	132	67.3
Father	49	25.0
Others(Grandmother, Grandfather, Aunt, Uncle)	15	7.7
Literacy of the Parents		
Illiterate	70	35.7
< Primary	39	19.9
Upto Matric	87	44.4
Income Adequacy Level		
Low Income	180	91.8
Middle Income	14	7.1
High Income	2	1.0
Smoking	YES n (%)	NO n (%)
Do you smoke?	15 (7.7)	181 (92.3)
Spouse- smoker	45 (23.0)	151 (77.0)
Any family member smoke.	46 (23.5)	150 (76.5)

Demographic profile

a) Asthmatic Child Profile

The total sample was 196 asthmatic children aged 4- 12 years with mean age 8.94 (years) \pm 2.48 (SD). The majority of children were male 119(60.7%), and 77 (39.3%) were female. Asthma diagnosis mean age was 5.77 \pm 2.59 (SD). About

one fourth 47 (24.0%) asthmatic children had suffered from allergic rhinitis, 179 (91.3%) had seasonal allergy (especially in winter season) and, a greater proportion 190 (96.9%) had a complaint of food allergy. More than half of the children 108(55.1%) had a higher incidence of the emergency room/ asthma clinic visits < 7 in the

previous six months and, 25 (12.8%) participants had a history of 1-2 times hospitalization in the previous six months. Nearly a half 90 (45.9%) participants had a family history of asthma, majority were grandparents 62 (31.6%), 9(4.6%) were parents and 5(2.6%) were siblings with asthma (Table 1).

b) Parents/ Guardian Profile

Nearly three quarters Parents/ Guardians 143 (73%) were female, and 53 (27%) were male with mean age 36.34 (years) ± 7.30 (SD). The total sample size of guardians comprised of 132(67.3%)

mothers, 49(25.0%) were fathers and, 15(7.7%) were others (Grandmother, Grandfather, Aunt, Uncle). Moreover, the majority of guardians 70 (35.7%) indicated that they had no exposure to schooling, 39(19.9%) were at < Primary and, 87(44.4%) were up to Matric level. Parents/ Guardians indicated low, medium and high income adequacy 180(91.8%), 14(7.1%), and 2(1.0%) respectively. Guardian smokers were 15 (7.7%), spouse-smokers were 45 (23.0%) and, 46 (23.5%) were any other family member involved in smoking (Table 1).

Table 2: Presenting the environmental profile

c) Environmental Profile	(%)	(%)	(%)
Living area	Rural (%)	Urban (%)	Sub-urban (%)
	41 (20.9)	118 (60.2)	37 (18.9)
Housing condition	Kaccha (%)	Pacca (%)	Mixed (%)
	23 (11.7)	143 (73.0)	30 (15.3)
Number of rooms	1-2 (%)	3-4 (%)	>5 (%)
	119 (60.7)	54 (27.6)	23(11.7)
Household members	2-4 (%)	5-7 (%)	>8 (%)
	13 (6.6)	78(39.8)	105(53.6)
Housing ventilation	Congested/ poor-ventilated n (%)		Well Ventilated (%)
	118 (60.2)		78 (39.8)

c) Environmental Profile

The majority of parents/ guardians 118(60.2%) were living in urban areas, 143 (73.0%) parents had cement constructed homes, 119 (60.7%)

parents homes had 1-2 rooms and,118 (60.2%) homes were congested with poor ventilation. More guardians families 105(53.6%) comprised of >8 household members (Table 2).

Table 3: Presenting the trigger factors of asthma

S.#	Questions	Patient Responses	
	Which of these trigger factors precipitate asthma in your child?	YES= N (%)	NO= N (%)
1.	Tobacco smoke	113 (57.7)	83 (42.3)
2.	Dust/ Air pollution	178 (90.8)	18 (9.2)
3.	Flower/Pollen	86 (43.9)	110 (56.1)
4.	Strong odor	98 (50.0)	98 (50.0)
5.	Child exercise	146 (74.5)	50 (25.5)
6.	Child sports	146 (74.5)	50 (25.5)
7.	Cold air/cold weather	181 (92.3)	15 (7.7)
8.	Medicines like tab Disprine, syp/tab Brufen	2 (1.0)	194 (99.0)

Trigger Factors of Asthma

When parents were asked about what factor triggered asthma in their children, 113 (57.7%) parents agreed about tobacco smoke, 178 (90.8%) agreed about Dust/ Air pollution, 146 (74.5%)

agreed about Child exercise & Child sports, and 181 (92.3%) were agreed on Cold air/cold weather causes to precipitate asthma in their children (Table 3).

Table 4: Presenting the factors Influence on asthma control

Influencing Factors		Not Well-Controlled (N = 115)	Well-Controlled (N = 81)	p-Value
Age of Child		8.86	9.03	.643
Age of Parent/ Guardian		35.81	37.07	.236
Parents/ Guardians Perception of Control by Gender	Male	29 (54.7%)	24 (45.3%)	.493
	Female	86 (60.1%)	57 (39.9%)	
Child's Perception of Control by Gender	Male	65 (54.6%)	54 (45.4%)	.152
	Female	50 (64.9%)	27 (35.1%)	
Income Adequacy Level	Low Income	105(58.3%)	75(41.7%)	.151
	Middle Income	10(71.4%)	4(28.6%)	
	High Income	0	2(100.0%)	
Allergic Rhinitis	Yes	36 (76.6%)	11 (23.4%)	.004*
	No	79 (53%)	70 (47%)	
Seasonal Allergy	Yes	111 (62%)	68 (38%)	.002*
	No	4 (23.5%)	13 (76.5%)	
Number of Rooms	1-2 rooms	80 (67.2%)	39 (32.8%)	.008*
	3-4	26 (48.1%)	28 (51.9%)	
	>5	9 (39.1%)	14 (60.9%)	
Child Exercise	Yes	92 (63%)	54 (37%)	.035*
	No	23 (46%)	27 (54%)	
Child Sports	Yes	93 (63.7%)	53 (36.3%)	.015*
	No	22 (44%)	28 (56%)	
Cold Air/ Cold Weather	Yes	112 (61.9%)	69 (38.1%)	.002*
	No	3 (20%)	12 (80%)	
Parents/ Guardians Education Level	Status	Knowledge		.035*
		Inadequate	Adequate	
	Illiterate	40 (57.1%)	30 (42.9%)	
	< Primary	14 (35.9%)	25 (64.1%)	
	Up to Matric	34 (39.1%)	53 (60.9%)	

The objective of the study was to determine the factors and their association with asthma control, and we used the Chi square test.

Factors Influence on Asthma Control

To find out association between male & female guardians about control of asthma chi-square test was performed, but there was no association between male & female guardians. Although, a greater number of the participated parents were females; 39.9% female's parents reported well controlled but it has lower value than male's parents reported 45.3% asthma controlled in their children. Similarly, female's guardians reported 60.1% and males guardians reported 54.7% uncontrolled asthma in their children. The t-tests for Parent/ Guardian and Children perception of control by age illustrated there were not statistically significant differences. Older parents reported asthma well controlled in their children more than younger parents/ guardian. The mean age of parents with controlled asthma in their children was 37.07 whereas the mean age of parents having

children with uncontrolled asthma was 35.8. The mean age of the children reporting asthma well controlled or not well-controlled was about the same. The Chi-Square test showed there were not statistically significant differences between male & female children. Generally male children reported asthma well controlled than females but it was not statistically significant. The Chi-Square test illustrated that there was not statistically significant differences between income adequacy and asthma control but it clearly elaborated that low-income could hasten poor asthma control. Children with high income adequacy had asthma well-controlled than did children with low income adequacy. Chi square test revealed that there was significant association between knowledge about asthma and parents' education level. As education level increases knowledge about asthma also increases (Table 4). The chi square test revealed there was significant association between asthma control and allergic rhinitis. The frequency 70(47.0%) of asthma control was significantly higher in those children who had not allergic rhinitis as compared to those who had

11(23.4%) allergic rhinitis. Similarly, Chi square test revealed that there was significant association between asthma control and seasonal allergy. The frequency 13(76.5%) of asthma control was significantly higher in those children who had no seasonal allergy as compared to those who had 68(38.0%) seasonal allergy. Chi square test revealed that there was significant association between asthma control and the number of rooms. The frequency of asthma control was significantly higher 14(60.9%) in those children whose parents had a big home with more than 5 rooms as compared to those children 39(32.8%) whose home was small with 1-2/ 3-4 rooms. The children who lived in home (3-4 or >5) were more similar in their asthma control as compared to those children who lived in home with 1-2 rooms home. Chi square test revealed that there was significant association between asthma control and exercise. The frequency of asthma control 27(54.0%) was significantly higher as compared to those children 54(37.0%) who did not use exercise. Chi square test also affirmed that there was significant association between asthma control and cold weather. The frequency of asthma control 12(80.0%) was significantly higher in children who had no allergic to cold weather as compared to 69(38.1%) other children who allergic to cold weather (Table 4).

Discussion

Asthma is one of the most prevalent chronic diseases in children²⁷. Asthma can affect people at any age but it is usually considered as a childhood disease as children are much more affected than adults²⁸. The debilitating effects of this condition place a huge burden on millions of children and their families and, it is increasing day by day²⁹. It is not a curable disease but it can be controlled through adherence to an effective medical management plan and treatment of coexisting medical conditions e.g., rhinitis and prevention from environmental triggers³⁰. Though the burden of asthma is increasing day by day, the reason for this increase is yet unknown⁵. The causative factors may include both genetic and environmental, while numerous studies have been conducted worldwide to identify the risk factors of asthma. The family history of asthma, child's personal history of allergic rhinitis³¹ child exposure to passive smoking, children living in smaller houses without proper ventilation and without adequate sunlight have been confirmed to be significant risk factors for asthma⁵. The current study identified following factors linked with asthma.

Allergic Rhinitis and Seasonal Allergy

Several studies have shown that allergic rhinitis is not only a risk factor, but it usually precedes the

asthma in affected patients and has a major impact on asthma morbidity, as treating allergic rhinitis is a great contribution in asthma control. Not all asthmatic patients have allergic rhinitis and similarly not all patients with allergic rhinitis have asthma. However, evidence provided that they are strongly linked with each other³². Results of our study showed that 47(24.0%) children participants had a history of allergic rhinitis, 179 (91.3%) participants suffered with seasonal allergy and only 5(2.6%) participants had other allergic condition e.g. skin allergy (atopy) (Table 1). This study also affirmed that there were significant associations between asthma control and variables like allergic rhinitis $p=.004^*$ (Table 4), seasonal allergy $p=.002^*$ (Table 4). Significant associations between allergic rhinitis and asthma also affirmed by many studies, one of them Mohammad et al (2009) reported that frequency of allergic rhinitis was 61.6 % in patients with asthma and there was a significant positive $P < 0.001$ association between allergic rhinitis and asthma³². A positive association between allergic rhinitis and asthma control was found in numerous other studies^{33, 34}. Results of above studies are similar to that of ours. Allergic rhinitis (AR) is a common co-morbid condition in asthmatic children and has a major influence on asthma control, and treatment of AR may help to decrease asthma morbidity and improve level of asthma control.

Food allergies

Food allergies may be the one of risk factors in asthma development and asthma control in children. In our study majority parents 190 (96.9%) reported that their child had food allergy (Table 1), but we did not find an association between food allergy and asthma. Different studies had showed that food allergies may or may not have any association with asthma and level of asthma control. Schroeder et al (2009) indicated that there was a strong positive association ($p < 0.0001$) between asthma and the number of food allergies³⁵. Another study among asthmatic children by Calamelli et al (2008) reported 23% children presented with food allergy but there was no significant association found between food allergy and degree of severity of asthma although children without food allergy had better controlled asthma (25%) than those children who had asthma with food allergy (only 12%)³⁶. However, food allergy must be investigated in asthmatic children to find out any association with asthma severity and control of asthmatic symptoms.

Income Status

In terms of socioeconomic factors, income may be the crucial factor in asthma control among children. In our study the majority of parents 180(91.8%)

had lower income adequacy (Table 1), but we did not find an association between income adequacy and asthma control. Children with high income adequacy had asthma well-controlled than children with low-income adequacy (Table 4). Significant associations between income status and asthma control also affirmed by some studies. BinSaeed et al (2014) reported that low household income, and household crowding were associated with poor asthma control among children. They identified Odds Ratio of income and crowded homes with uncontrolled asthma were 2.30 (95% CI = 1.02–5.21) and 3.33 (95% CI = 1.33–8.35), respectively³⁷. Another study by Cope et al (2008) indicated that asthmatic children of lower income adequacy families had poorer asthma control with p value (0.0027). The highest income adequacy level had a positive impact on asthma control among children as compared to lowest income adequacy level.³⁸

Heredity Contribution

It has been established that genetic susceptibility contributes to the risk of developing asthma in children³⁹. In current study 90(45.9%) children had a family history of asthma (Table 1). Similarly, a survey was carried out among parents of asthmatic children in Malaysia determined that 69% children had a history of asthma in close relatives and 47% children had a parent's history with asthma⁴⁰. These studies showed congruency with current study findings. Furthermore, the parents who had previous exposure to asthma had significantly better knowledge about treatment therapy and were ($p < 0.05$) more receptive for information about asthma.^{41, 42}

Multiple Trigger Factors

Our results demonstrated the views of parents about asthma trigger factors e.g., cigarette smoke, dust/ air pollution, cold air/ cold weather, and, pollen.

Passive smoking

There were 106 (54.08%) children participants who had exposure of passive smoking as one or both of their parents smoked 30.61% while 23.5 % have exposure due to smoking of other family member in their homes (Table 1). In our study 41.7% children had good asthma control and one of the factors contributing significantly to this good control was that parents of these children either were not smoking or avoiding smoking in homes and smoking outside only²⁶. McGhan et al (2006) found that 67(44%) parents had smoke exposure in their homes and their children suffered with uncontrolled

asthma as compared to non-smokers household⁴³. Studies have shown that exposure to tobacco smoke perpetuates the poor control of asthma despite medication therapy and acceptable asthma control in those children was difficult to attain.

Urban area, small and improper ventilated homes

Our results showed that most of 118(60.2%) participants were from urban areas and majority 143(73.0%) had pacca cemented homes and most 119(60.7%) of the parents were living in 1-2 rooms home. The majority 105(53.6%) participants had family members >8 and 118(60.2%) homes were congested with poor ventilation (Table 2). In addition, a positive significant association .008* was found between asthma control and number of rooms. The frequency of asthma control was significantly higher (60.9%) in those children whose parents had a big home with more than 5 rooms as compared to those children (32.8%) whose home were small with 1-2/ 3-4 rooms (Table 4). Majeed et al (2008) found that majority of the participants were living in urban areas and this is one of important risk factors for childhood asthma. A significant relationship $p < 0.0001$ was found between place of residence and asthma. More than half of the children 104(52%) were living in inner city areas and 170(85%) of the children were living in a flat or covered houses⁴⁴. Many studies found that problems of socioeconomic deprivation, including substandard housing conditions and residing in urban areas with lack of health services, correlated with increase hospital admissions. Although, precise reasons for increasing asthma in children are unknown, it is likely that some environmental factors are partly responsible for its increasing incidence. Rapid development in different cities like in Pakistan, with over population, increasing pollution, congested/ poor ventilated homes, and poverty, big family living in a one or two room home illustrated the double prevalence rate of respiratory diseases in children.

Exercise and Sports in changing weather may lead to asthma?

In current study 146 (74.5%) parents noticed that child exercise/ sports can precipitate asthma in their children (Table 3). Moreover, the significant association was found between asthma control and different variables such as child exercise .035* and child sports .015* (Table 4). A similar study was conducted in Portugal in 2013 among asthmatic children and their caregivers, to assess their knowledge regarding asthma. 44 (88%) parents noticed that playing sports in which their child had to run a lot was not good and 22 (44%) parents

noticed that exercising in cold weather could initiate an asthmatic attack⁴⁵. This study supported the findings of current study that exercise and sports in changing weather become a trigger for an asthmatic child. Another study supported current study in which 30% parents noticed that exercise is also a trigger factor for asthma initiation in their children²⁴. A study conducted in Birmingham, UK in 2015 showed dissimilar results increased physical activity (PA) may be beneficial for children with asthma. Six weeks exercise intervention was designed for the children and child attendance was monitored exercise intensity and the child's perception of participation. On the whole they enjoyed and reported no limitation due to asthma or no asthma attacks was noted. Rather, the children noticed that their fitness and asthma had improved, and they also reported increased the HRQoL (health-related quality of life)⁴⁶. Keeping in view the results of these studies that parents of the asthmatic child should be made aware for optimum asthma management every individual needs to adhere to asthma management plan and regular monitoring of airway state with a peak flow meter and also use of pre-exercise medication that allows the most asthmatics to participate in physical activity (exercise and sporting events)⁴⁷.

Cold Air/ Cold Weather & Dust

In our study the majority of the parents 181 (92.3%) reported that cold air/ cold weather was a precipitating factor of asthma in their children (Table 3) and also affirmed that there was a significant association between asthma control and, cold air/ cold weather $p = .002^*$ (Table 4). A great number of parents 178 (90.8%) also reported that dust/ air pollution was a trigger factor of asthma in their children (Table 3). Balaji et al (2015) reported that majority 21% of children had exposure to dust as a triggering factor of asthma when compared to cold that was only 5% but combined cold and dust were triggering factors in 27% of children. Whereas combined dust, cold and exercise factors were found in 3% children. These detected factors were common in all school environments. Raising awareness about such factors, including their identification and avoidance may alleviate exacerbation rates and improve their quality of life with asthma⁴⁸. These study findings were similar to the current study findings.

Asthma Knowledge and Parents' Education

The current study showed that there was significant association between asthma knowledge and the parents' education level. As education level increases knowledge about asthma also increases ($p = .035^*$) (Table 4). Fadzil & Norzila (2002) found

that the parents had inadequate knowledge about asthma but there was a positive correlation found between parental asthma knowledge and the level of parents education ($p = 0.01$)⁴¹. More efforts should be made to disseminate knowledge about asthma among the parents for better asthma control in their children.

Conclusions

There is a lack of research surrounding the awareness of childhood asthma as well as influencing factors in Pakistan. To this end, the findings of this study reveal that there were many factors that had significant association with asthma control included (allergic rhinitis, seasonal allergy, the number of rooms in house where child lived, exercise, child sports, and cold weather). There was no association found between food allergy and asthma. It has also revealed that there was a significant association found between asthma knowledge and the parents' education level. As education level increases knowledge about asthma also increases. The current study also highlighted that, female parents have better knowledge regarding asthma control as compared to male parents. In addition, low- income could have an effect on asthma control among children.

Environment factors can trigger the onset or exacerbation of asthma, therefore controlled environment along with medication should be the part of treatment of asthmatic children. Further studies need to be conducted in other metropolis cities to rule out other factors that contribute to the highly prevalence of allergic respiratory diseases and asthma in Pakistan.

Acknowledgment

The authors acknowledge the University of Health Sciences Lahore for provision of a conducive intellectual environment to its students. We would like to thank Prof. Masood Sadiq (Prof of Paediatric Cardiology) Chairman Institutional Review Board of Children Hospital Lahore, and, Dr. Aslam (Head of the Department of Paediatric) of Sheikh Zaid Hospital Lahore, for granting permission of data collection in their respective Hospitals. We are thankful to Waqas Latif, (Biostatistician/Data Analyst) for guiding us in drawing results of our study. Special thanks goes to 196 parents with their asthmatic children who really spared their precious time for interview session and shared valuable information.

Conflict of Interest: None to declare.

Grant support and financial disclosure: None to disclose.

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