

Environmental Pollutants and Airborne Allergens Associated with Bronchial Asthma among School Children in Puducherry, India: A Cross - Sectional Study

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Abstract: ***Background:** To define environmental risk factors influencing asthma prevalence and to see if there is gender difference in asthma prevalence and to assess the risk factors for asthma. **Methods:** A cross sectional study was conducted among 1250 school going children (Age 8–17 years) attending to private and government schools in the urban area of Puducherry during the academic years 2008 and 2009. Of the five schools 2 were boys' schools, 2 were co - education schools and 1 was girls' school, using a bilingual questionnaire. We collected data regarding asthma prevalence, incidence of wheezing, gender difference in prevalence and exposure to environmental pollutants. **Results:** Prevalence of previously diagnosed asthma cases among school children is 4.97%. The study results on comparison show that there is asthma at the ratio of 2: 1 prevalent in boys and girls. Incidence of reported wheeze in the last 12 month duration before the study is 14.17% from the study group of 1247. Nasal allergies and skin eczema are significant risk factors for wheezing (P Value=0.0000). Pneumonia in infancy (P Value=0.0000), Parental asthma (P Value=0.0005) and male infants with pneumonia are more prone for asthma. **Conclusion:** There is a significant gender difference in prevalence of asthma and there is a significant correlation between family history of asthma among parents and children having wheezing, breathing difficulty and asthma. There is significant correlation between environmental factors and Bronchial asthma.*

Keywords: Bronchial asthma, school children, environmental pollution

1. Introduction

Asthma is the most common chronic lung disease. It is a complex disease with environmental, psychosocial and biological components and it is a growing major health problem¹. Asthma is a multifactorial disease that may have different expressions depending on family and medical history, lifestyle and environmental exposures¹. Chronic inflammation and smooth muscle dysfunction are consistent features of asthma pathophysiology². Pediatric asthma is a major clinical concern worldwide that exerts a tremendous burden on family and healthcare resources. It also accounts for lost school days and deprive the child of academic achievements and social interactions³. There are complex and confounding associations and relationships with infections and infestations, air pollution, tobacco smoking and environmental tobacco smoke exposure. The overall burden of asthma in India is estimated at more than 15 million patients⁵. Under diagnoses and under treatment of asthma is a frequent problem due to lack of information to health care providers and for social reasons⁴. Environmental exposures is at least one of the most important causative factor, environmental exposures may be a risk factor is more amenable to successful public health measures than are other factors such as social or psychosocial problems. Puducherry is a town in south India. Our study is an observational study and describes the characteristics of diseased such as their age, socio economic characteristics and presenting features.

It gives in many instances, preliminary information which can raise hypothesis for a study.

2. Methods

A cross sectional study was conducted among 1250 school going children (Age 8–17 years) attending to private and government schools in the urban area of Puducherry during the academic years 2008 and 2009. Of the five schools 2 were boys' school, 2 were co - education school and 1 was girls' school, using a bilingual questionnaire. We collected data regarding asthma prevalence, incidence of wheezing, gender difference in prevalence and exposure to environmental pollutants.

The questionnaire used has two components. The first components are aimed at collecting information on demographic and environmental exposure factors influencing the prevalence of asthma. Besides demographic data, information on smoking habits, domestic cooking fuel used, atopic symptoms, and family history suggestions of asthma was collected. The second part of the questionnaire is aimed at collecting information on respiratory symptoms and establishing a diagnosis of asthma based on this data. Our questionnaire is a closed ended questionnaire. Wordings in questions were given adequate attention to be specific, undemanding, unbiased, relevant, brief, non - threatening and unambiguous, the questions were made simple enough to be easily understood by the respondent. The questions

were sequenced so that they flow in a logical order. Questions were grouped in ways which will seem sensible and understandable to the respondents. Pilot testing of the questionnaire was done after translation into the local language. It was printed in bulk for administration to the sample population. Asthma tends to be more prevalent. It is a cross sectional study involving only urban school children. The sample size is 1250. The sample size was calculated on the assumption that about 15% children aged 8 - 17 would have wheezing. $n = 4pq/l$, p - prevalence, $l=1.5\%$ precision. Children with heart diseases and other respiratory diseases like TB are excluded from this study. Asthma is to be diagnosed if the respondent answered, affirmatively both to (a) whistling sound from chest or chest tightness or breathlessness in morning (b) having suffered from asthma, or having an attack of asthma in the past 12 months, or using bronchodilators.

Statistical Analysis

Univariate and multi variate logistic regression study modelling and odds ratio of various potential risk factors. Continuous variables such as weight, monthly income are to be compared by t - test. Categorical variables were tested by chi - square test.

3. Results

The study included 512 girls and 738 boys respectively. Of which, 37 girls were wheezers and 16 girls were known asthmatics. 89 boys were wheezers and 46 boys were known asthmatics. Results of the total children surveyed the incidence of wheeze is 14.17%. 1.92% of the total wheezes have either heart or other respiratory illness. The incidence of wheezing among asthmatics is 2.24%. Among the known asthmatics there is significant difference in prevalence between male and female. 6.23% of the total known asthmatics are male and 3.12% are female. The study results on comparison show that there is asthma at the ratio of 2: 1 prevalent in boys and girls. the study results after analysis that risk factors like nasal allergies, skin eczema are risk factors for wheezing ($Pvalue=0.0000$). History of pneumonia in infancy is a significant risk factor for asthma and wheezing ($Pvalue= 0.00000$). There is a significant correlation between parental asthma and their children having wheezing, breathing difficulty and asthma ($Pvalue= 0.00005$). There is no significant correlation between asthma and presence of live stocks in house. Incidence of wheezing and breathing difficulty among known asthmatics is significantly high among children surveyed. There is a significant gender difference in incidence of pneumonia in infancy. Male infants are more prone to LRI/pneumonia. The prevalence of nasal allergy is high in children with eczema and vice versa. There is a significant correlation between smokers in the family and wheezing in their children.

Table I: Correlation between wheezing and family members who are smokers

Family members, smokers and wheezing cross Tabulation

Family Members	Wheezing						Chi Square Value	P - Value
	Yes		No		Total			
	n	%	n	%	n	%		
Smokers	32	26.23	159	14.27	191	15.45	12.032	0.00052*
Non - Smokers	90	73.77	955	85.73	1045	84.55		
Total	122	100	1114	100	1236	100		

*Significant (at 5% and 1%)

The above tabular column gives the relationship between smokers in the family and children with wheezing. There are 122 wheezers in our study in which 32 students have smokers in family which is equal to 26.23%. There are 191 (15.45%) children with smokers in family, among them 32 (16.7%) have history of wheezing. The P value is 0.00052 and there is a significant correlation between smokers in family and wheezing in their children.

Table II: Correlation between live stocks and presence of asthma in Children

Presence of Live stocks in house and Asthma among children Cross Tabulation

Live Stocks	Asthma						Chi Square Value	P - Value
	Yes		No		Total			
	n	%	n	%	n	%		
Yes	11	18.33	256	21.73	267	21.57	0.39	0.532*
No	49	81.67	922	78.27	971	78.43		
Total	60	100	1178	100	1238	100		

*Significant (at 5% and 1%)

The above tabular column shows the relationship between students suffering from asthma and who have live stocks in their houses. The tabular column shows that 11 out of 60 (18.3%) have live stocks. In the study we have found that 267 children have live stocks in their houses and 11 (14.1%) out of them have asthma. There is no significant association between asthma and presence of live stocks in house.

Table III: Correlation between ventilation in house and wheezing in Children

Presence of ventilation in houses and wheezing in children Cross Tabulation

Ventilation	Wheezing						Chi Square Value	P - Value
	Yes		No		Total			
	n	%	n	%	n	%		
Adequate	90	71.43	975	88.72	1065	86.94	29.754	0.0000*
Not Adequate	36	28.57	124	11.28	160	13.06		
Total	126	100	1099	100	1225	100		

*Significant (at 5% and 1%)

The above tabular column shows the relationship between wheezing and ventilation in students' houses. 36 (28.57%) students out of 126 students with wheezing don't have adequate ventilation. The P value for the test is 0.0000. There is a significant association between inadequate ventilation and wheezing.

4. Discussion

In the present study, male to female ratio is 2: 1 for asthma prevalence. The prevalence is more among boys which is

very similar to the previous study conducted. The prevalence of wheezing among male children also is high when compared to girls. 24.26% of boys and 13.48% of girls had wheezing in the last 12 months.

There is a significant association between parents suffering from asthma and children having wheezing and asthma. The p value is less than 0.005.

As per the International Asthma and allergy study in childhood phase II, asthma and wheeze are associated with family history of asthma, smoking, occupation, frequent chest colds, students working for wages, exposed to animals, eating in kitchen.⁶

A positive family history of asthma and presence of smokers in the family emerged as significant risk factors.⁷

The relationship between household tobacco smoke exposure and wheezing in children was investigated to assess passive smoking. The result showed that household passive smoking may be a predisposing and or aggravating factor for wheezing. 15.45% of the children have family members who are smokers. The P- value is 0.0052 and there is significant correlation between wheezing and smokers in family.

Farming and exposure to livestock have been proposed as protective against the development of asthma in children. In our study, we conclude there is no significant increase in the prevalence of asthma and livestock.

Significantly inadequate ventilation in the house of the children has a significant association with wheezing.

Pneumonia in Infancy: In our study, there is a significant correlation between children who suffered with Pneumonia/LRI in infancy childhood asthma, wheezing and respiratory symptoms.

5. Conclusion

In this study we conclude that male sex are more prone for asthma and wheezing than female sex. Parental smoking is a risk factor for asthma. Presence of nasal allergies, skin eczema and pneumonia in infancy are significantly high in children with asthma. Livestocks and animals in house are not very significant risk factors for asthma. Poor housing and poor ventilation inside the house are a significant risk factor for asthma.

6. Declaration

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Conflict of interest: none declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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