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Bronchial asthma: Prevalence and risk factors among children in urban population from Raipur, Chhattisgarh

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Abstract:

OBJECTIVES: Bronchial asthma is an important chronic disease in children leading to school absenteeism, hospitalization, economic and psychological stress in the family. Worldwide, the prevalence of asthma is on rise. There is a paucity of information on the prevalence of bronchial asthma in childhood in Central India. Hence, this community-based study was conducted with an objective to estimate the prevalence of asthma and identify associated risk factors in children between 6 and 14 years of age.

MATERIALS AND METHODS: This cross-sectional study using modified International Study of Asthma and Allergies in Childhood questionnaire was conducted in the urban area of Raipur, Chhattisgarh, India. The calculated study sample of 175 children in the age group of 6–14 years was recruited using multistage random sampling.

RESULTS: Of 175 (88 males and 87 females), 13.14% (23) of the participants had wheezing at any time in the past and 5.14% had wheezing in the past 1 year (asthma prevalence). The prevalence was slightly more (5.9%) in 6–9 years. Boys had more prevalence (5.6%) than girls (4.6%). However, more girls were affected (5.4% vs. 3.7%) in the age group of 10–14 years. Major risk factors with statistically significant “*P*” values were allergic rhinitis (66.6%) (Relative Risk (RR) = 6.9), family history of bronchial asthma (66%) (RR = 4.6), maternal asthma (33.3%) (RR = 6.9), and upper socioeconomic class (55.5%) (RR = 2.9%). Important triggers were inhalants, cold exposure, exercise, irritants, and infections.

CONCLUSION: The prevalence of asthma in children was 5.14%. The significant risk factors were allergic rhinitis and family history of asthma, specifically maternal asthma.

Keywords:

Bronchial asthma, prevalence, risk factors, urban children

Introduction

Bronchial asthma is an important health issue mainly in developing countries like India.^[1] Apart from being the leading cause of hospitalization for children, it is one of the most important chronic conditions causing elementary school absenteeism. It has also increased the number of preventable hospital emergency visits and admissions.^[2,3] The global strategy for asthma management

and prevention guidelines define asthma as “a chronic inflammatory disorder of airways associated with increased airway hyperresponsiveness, recurrent episodes of wheezing, breathlessness, chest tightness, and coughing.”^[4]

Since 1970, the prevalence of bronchial asthma has increased continuously, and now, it affects an estimated 4%–7% of people worldwide.^[5]

It is estimated that 14% of children in the world experience asthma symptoms.^[6] The prevalence has been seen more in urban

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than in rural areas.^[7] When segregated by gender and age, asthma is seen more in boys in the age group of 12–14 years and more in girls in the age group of 14–16 years.^[8] India accounted for 277 disability-adjusted life years lost per 100,000 population and 57,000 deaths in the year 2004.^[9]

Bronchial asthma is often underdiagnosed and undertreated during the childhood, which may lead to severe psychosocial disturbances in the family.^[10] The diagnosis of asthma is dependent on the clinical presentation of bronchospasm, variable airway narrowing, bronchial hyperresponsiveness, airway inflammation, and response to inhaled bronchodilators or corticosteroids. Spirometry can be used to diagnose asthma, but its results are often normal, and also it is difficult to perform spirometry in small children. Even the reversibility to bronchodilators is not consistently present.

In the past 10 years, the proportion of Indian school children suffering from bronchial asthma has increased to more than double.^[11] The increase in the prevalence of bronchial asthma in children may have serious implications in their adult life, as 40% of children with trivial wheeze and 70%–90% of those with troublesome asthma continue to have symptoms in mid-adult life.^[12] It is also shown that male sex, a positive family history of atopic disorders and the presence of smokers in the family are significant factors that influence the development of asthma.^[1] This problem is increasing in urban areas as a result of increase in environmental smoke and air pollution. In India, the obstacles to asthma care are the costs of care and medications, the socioeconomic disparity within the country, use of multiple languages, cultural issues, and the common use of alternative remedies.^[13] The magnitude of the problem of asthma has not been defined with certainty although numerous epidemiological studies have been carried out worldwide. Indeed, the prevalence studies of asthma lack consistency, possibly because of the ill-defined diagnostic criteria, nonstandardized study protocols, and different methodologies.^[5]

There are not many studies done on the prevalence of bronchial asthma in children from the state of Chhattisgarh. Raipur city was reported as the 7th most polluted city in the world in the WHO report published in 2016. As stated earlier, air pollution is one of the risk factors as well as triggering factor for asthma. Hence, this study was conducted to find out the prevalence of asthma and associated risk factors among children residing in the urban area of Raipur city.

Materials and Methods

The study was conducted after approval from the Ethics Committee of the Institute. (IEC Proposal

No: AIIMSRRPR/IEC/2017/078). It was an observational, cross-sectional study conducted in the urban area of Raipur, Chhattisgarh, India. The data collection was performed during the 2 months (June 1, 2017–July 31, 2017). Analysis and interpretation of the data were done in the subsequent 2 months. The sample size was calculated using the formula $4pq/d \times d$ where p was taken as 7.59% based on a previous similar study done in Jaipur, q is $100 - p$ and absolute allowable error (d) of 4%.^[8] The minimum sample size calculated was 175. Multistage random sampling was used to achieve the sample size.

Inclusion criteria

1. All children in the age group of 6–14 years residing in the identified geographical area were included in the study.

Exclusion criteria

1. Children having any underlying chronic lung disease such as tuberculosis or any restrictive lung diseases
2. Children with congenital heart diseases were excluded from the study.

Study setting and study tool

This was a community-based study using the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire. The ISAAC questionnaire is a well-validated tool and has been used in many different studies by different researchers worldwide after translation and suitable modification. In the present study, we used a questionnaire which was divided into three parts.

Part I: Demographic details

This part had information related to the study participants' demography including contact details and anthropometry.

Part II: Core questionnaire

This part had three sections. Section A included eight questions which were adapted as it is from the ISAAC core questionnaire for asthma. Similarly, Section B had six questions and Section C had seven questions for allergic rhinitis and eczema, respectively.

Part III: Associated risk factor

This part of the questionnaire was related to risk factors and triggers related to asthma, environmental history including environmental tobacco smoke exposure and outdoor and indoor air pollution. It also had questions especially related to risk factors such as family history of asthma, allergic rhinitis, or atopic eczema in parents, sibling, or any blood relatives.

The investigator herself filled the questionnaire after getting information from the parents or children

themselves depending on the age and understanding of the participant. The questionnaire was translated into local language and back into English.

Raipur city has eight zones with 70 wards. One of the zones was randomly selected. The zone selected had nine wards. Of these nine wards, one ward was selected by simple random sampling. This ward had five mohallas (localities). From each mohallas, approximately 35 children were randomly selected. We first went to one prominent landmark or crossroad in each mohalla. A pen was set into circular motion and the direction of the tip was selected as the direction for selecting the household. The first household with children fulfilling the criteria was selected, and then, subsequent houses were selected by visiting each house in the same direction till desired numbers of participants were recruited. Informed consent was obtained from the guardian and wherever possible assent was obtained from the child.

The data collected were entered into the Microsoft Excel sheet and coded. Frequencies and percentages were obtained using descriptive statistics. Relative risk (RR) was calculated for various factors.

Results

In the present study, a total of 175 children fulfilling the inclusion criteria were interviewed. Table 1 shows the age- and sex-wise distribution of the study population.

According to the modified Kuppaswamy scale, out of 175 study participants, 36 (20.6%) belonged to the upper class. Sixty-nine (39.4%) belonged to middle class and the remaining 70 (40%) belonged to the lower class.

Out of 175 children, 23 (13.14%) had a history of wheeze anytime in the past. For the calculation of the prevalence of asthma, we considered the history of wheezing in the past 1 year. Accordingly, the prevalence of asthma was

5.14%. Nine children out of 175 had a history of wheezing in the past 1 year [Table 2].

Wheezing was significantly associated with allergic rhinitis, family, and maternal history of asthma [Table 3]. Although other factors such as family history of asthma, other allergies, paternal asthma, and atopic dermatitis increase the risk of wheezing, it was not statistically significant.

Discussion

In the present study, out of 175 children enrolled a male:female ratio was found to be 1.01 (88 males and 87 females). Nearly 61.7% were in the age group of 10–14 years. In our study, majority of the children belonged to middle and lower socioeconomic class as per modified Kuppaswamy classification which is similar to the study done by Jain *et al.*, where majority of the families were from the low socioeconomic class.^[14]

Chakravarthy *et al.* reported that symptoms suggestive of asthma were present in 18% of children under 12 years of age. They also found that the prevalence of breathing difficulty and nocturnal cough was significantly higher among urban children in 6–12 years of age group. Children living in urban areas reported recent wheeze more often than rural children.^[7]

Awasthi *et al.* reported the low prevalence of asthma (2.3% and 3.3% in 6–7 and 13–14 years of age group, respectively) in children surveyed in Lucknow, North India. This study also reported a low prevalence of wheezing any time in life, i.e., 6.2% in the age group of 6–7 years and 7.8% in 13–14 years, respectively, as compared to our study which was 11.9% and 13.8% in 6–9 years and 10–14 years, respectively. This study also found that among the ever wheezers, almost one-fourth reported asthma which was less than the present study.^[15] In a study done by Masoli *et al.*, it was found that among those who were ever wheezers, >80% reported asthma similar to our study.^[4]

In a study done by Kumar *et al.*, in Puducherry, they found a prevalence of ever asthma to be 5.3%, of which 4.2% had wheeze in the past year.^[1] These results are in

Table 1: Age and sex distribution of the participants

Age group (years)	Male (%)	Female (%)
6-9 (67)	35 (52.2)	32 (47.8)
10-14 (108)	53 (49)	55 (51)
Total=175	88 (50.3)	87 (49.7)

Table 2: Percentage of male/female population having wheeze at any time and in the past 1 year

Age group	Wheeze at any time (23)		Wheeze in the past 1 year (9)	
	Male (88)	Female (87)	Male (88)	Female (87)
6-9 (67)	6 (17.14)	2 (6.25)	3 (8.57)	1 (3.125)
10-14 (108)	7 (13.2)	8 (14.54)	2 (3.7)	3 (5.45)
Total	13 (14.7)	10 (11.5)	5 (5.7)	4 (4.6)
Total (175)	23 (13.14)		9 (5.14)	

concordance with our study. A study conducted in school children in Srinagar, India, the prevalence of the current asthma was 3.2%^[16] which is less than our study. In the review done by Pal *et al.*, of studies conducted during 1998–2004, the median prevalence was observed to be as 4.75% (with interquartile range = 2.65%–12.35%), and the mean prevalence was $7.24 \pm$ standard deviation 5.42.^[5] Jain *et al.*, in their study using ISAAC questionnaire done in rural children in South India found prevalence to be 10.3% which is higher than our study.^[14]

In our study, the prevalence among 6–9 years was more than those of 10–14 years. The prevalence was more among males in 6–9 years of age and more among females in 10–14 years of age. In the study done by Kumar *et al.*, in Puducherry, the prevalence was found more among 12–13 years of age group (6.5%) compared to 14–16 years of age group (3.6%).^[1] In the study conducted in Srinagar, the prevalence was more in boys (8.3%) than in girls (6.6%), with the prevalence in different age groups varying as per gender and the highest prevalence being in boys in the age group of 12–14 years (11.1%) and in girls in the age group 10–12 years (9.2%). The authors concluded that sex affects the development of asthma in a time-dependent manner. Male sex is a risk factor for asthma in prepubertal children, whereas female sex is a risk factor for the persistence of asthma into adulthood.^[16] Our results also favored these observations.

In our study, allergic rhinitis was found to be extremely associated with ever wheezers as well as current wheezers [Table 3] similar to other studies.^[1,16] In the study done by Kumar in Puducherry, 72.7% of the current asthmatics had cold or rhinitis which is slightly more than our study (66.6%). They also reported that 54.5% of current asthmatics had itching or rash, whereas

we found only 11.1% had itching/dermatitis.^[1] In a study done by Qureshi *et al.* in Srinagar, it was found that the prevalence of asthma was significantly higher in children having the history of atopic dermatitis and allergic rhinitis (32% and 16.9%, respectively), and family history of asthma 31.7%.^[16]

A statistically significant association was found between allergic rhinitis and asthma. Although 11% of current wheezers also had allergic rhinitis, this was not statistically significant.

It was observed in our study that the prevalence was significantly more among those with a family history of bronchial asthma similar to other studies.^[1,14,16] Although wheezing was more in children with the family history of allergic rhinitis, atopic dermatitis, or other allergic disorders, this was not found to be statistically significant.

The first comprehensive study for inheritance in asthma was undertaken by Cook and Varider veer in 1916. They came to the conclusion that the familial association was due to the genetic component. Since then, a number of studies have shown an association between family history and asthma.^[14] Paramesh observed that the incidence of asthma in children is high (18%) if one of the parents is having asthma, whereas incidence is 4% if any grandparent have asthma. Though asthma runs in families, and over 100 genes have been found to be associated with asthma, no single gene has been identified as causal.^[17]

Upper socioeconomic status (as per modified Kuppuswamy scale) was found to be a significant risk factor for asthma by Jain *et al.*, and Prasad *et al.*,^[14,18] We also had similar findings.

Table 3: Association of wheezing with various factors

Children with wheeze	AR (%)	AD (%)	F/H of A (%)	F/H of AR (%)	F/H of AD (%)	F/H of other allergy (%)	Maternal A (%)	Maternal AR (%)	Maternal AD (%)	Paternal A (%)	Paternal AR (%)	Paternal AD (%)
Any time in the past (23)	10 (43.48)	1 (4.35)	11 (47.8)	7 (30.4)	4 (17.4)	3 (13)	6 (26)	2 (8.7)	3 (13)	2 (8.7)	3 (13)	1 (4.35)
In last year (9)	6 (66.67)	1 (11.11)	6 (66.67)	2 (22.2)	1 (11.11)	1 (11.11)	3 (33.33)	1 (11.11)	0 (0)	1 (11.11)	0 (0)	1 (11.11)
Relative risk, <i>P</i> value (last year wheeze)	6.9, 0.0001*	Infinity**, 0.05	4.6, 0.0009*	2.2, 0.06	1.3, 0.5	3.07, 0.3	6.91, 0.0127*	2.63, 0.35	0**, 1	9.2, 0.14	0*, 1	3, 0.3

*Statistically significant (p value by Fisher Exact test $P < 0.05$), **Sample size inadequate for commenting on statistical significance. A=Asthma, AD=Allergic Dermatitis, AR=Allergic Rhinitis, F/H: Family History

Table 4: Association of wheezing with triggering factors

Triggering factors	Wheezing any time (23)	Wheezing in the past 1 year (9)	Relative risk, <i>P</i> value (last year wheeze)
Inhalants	14 (60.87)	8 (88.8)	13.4, <0.0001*
Exercise	2 (8.7)	2 (22.2)	36.8, 0.006*
Cold exposure	11 (47.8)	7 (77.7)	21.5, <0.0001*
Irritants	2 (8.7)	2 (22.2)	36.8, 0.007*
Infections	3 (13)	2 (22.2)	36.8, 0.007*

**P* value is statistically significant

In a review done by Pal *et al.*, environmental factors, including increasing exposure to pollution, allergies, tobacco smoke, and sedentary lifestyle, were identified as risk factors for asthma.^[5] Sharma and Banga in a study of prevalence and risk factors for wheezing in children from rural areas of North India, identified frequent passage of trucks through the street near home (OR 95% confidence interval [CI], 1.7 [1.2–2.4]), maternal smoking (OR: 95% CI, 1.5, [1.1–2.1]), paternal smoking (OR: 95% CI, 1.9 [1.3–2.7]) to be risk factors for asthma unlike our study where we could not find any statistical relation between distance of house from main road and asthma.^[19] The reason for this finding could be high pollution level in Raipur. We also had very few participants with environmental tobacco smoke exposure. The reason could be traditionally tobacco is used mostly in the form of gudakhu (tobacco tooth powder) rather than smoking. In the present study commonest environmental trigger reported for wheezing was various inhalants (88.8%). This was followed by cold exposure (77.7%) and exercise, irritants and infections (22.2% each) [Table 4].

Kumar *et al.* could not find any association between bronchial asthma and factors such as pets at home, birth order, and the absence of windows in living rooms like our study.^[1]

A study by Vyankatesh AA *et al.* found the family history of asthma, history of allergy, and the presence of cough without cold as statistically significant association with asthma. These findings are in concordance with our study.^[20]

Exposure to passive tobacco smoke has not been shown to be an important risk factor in our study, in contrast to that in other studies.^[1,5]

Conclusion

In our study, the prevalence of asthma was found to be 5.14%. The prevalence of asthma was more among males as compared to females and slightly more among 6–9 years than those in 10–14 years of age. The significant risk factors found to be allergic rhinitis and family history of asthma.

Strength of the study

It is a community-based study and probably first study done on the prevalence of asthma and associated risk factors in children from urban areas in Raipur.

Limitations

It was questionnaire based, and we did not confirm the diagnosis by any investigations. We did not use any audio or video to explain wheezing.

Future scope

This study can be further expanded in a large geographical area with a larger sample size to get a more generalized picture of the prevalence of asthma in children in Chhattisgarh (central east part of India).

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Conflicts of interest

There are no conflicts of interest.

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