

## **Under Diagnosis of Asthma in School Children and its Related Factors**

**Jasmeet Kaur, Krishan Chugh, Anupam Sachdeva and L. Satyanarayana\***

*From the Department of Pediatrics, Sir Ganga Ram Hospital, Rajinder Nagar, New Delhi 110 060, India  
and*

*\*Division of Epidemiology and Biostatistics, Institute of Cytology & Preventive Oncology (ICMR),  
Noida (UP), India.*

*Correspondence to: K. Chugh, Pulmonologist and Intensivist, Chairman, Department of Pediatrics, Sir Ganga  
Ram Hospital, New Delhi 110 060, India. E-mail: Chughk2000@yahoo.co.in.*

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*A cross-sectional study was carried out on one thousand school children studying in three public schools of Delhi and Haryana between 10 to 17 year age group over the period of one year (2001-02). It aimed in studying under diagnosis of asthma in school children and its related factors. Questionnaires including details of medical, social, environmental factors precipitating asthma were filled by the parents and class teachers. Pulmonary function test (PFT) was performed. Based on questionnaires and PFT results, children were grouped as labeled and unlabeled asthmatics. Cough was found to be equally prevalent in both the groups while wheezing and shortness of breath were independent and significant factors associated with getting a physician diagnosis.*

**Key words:** *Asthma, Spirometry, Under diagnosis.*

Childhood asthma is a condition that is under-recognized, under-estimated, under-treated and responsible for considerable morbidity among children(1-4). Reported risk factors for under diagnosis of asthma are female sex(3-6), low socioeconomic status(3,5,7), decrease physical activity(3), passive smoking(3,8) and serious family problems(3). Studies have found that amongst the unlabeled asthmatics, cough and other mild symptoms of asthma are predominant whereas wheezing and shortness of breath are more common among the labeled ones(2-4,9,10). In India studies determining the prevalence of asthma in school children (11,12) have been reported but no study has been done to determine the factors for underdiagnosis of asthma. Thus, we planned to study the under-diagnosis of asthma in school children and its related factors using questionnaires and pulmonary function tests.

### **Subject and Methods**

A cross-sectional study was carried out in

three English medium public schools, one situated at Delhi (Bal Bharti Public School, Rajinder Nagar) and the other two in Haryana, *i.e.*, Sohna (Sohna Public School) and Rewari (Jain Public School), approximately 60 and 90 km respectively from Delhi. The study was conducted at the same time when the hospital conducted the health camps in these schools. The sample size was calculated as 900 at 95% confidence interval, assuming the prevalence of asthma as 10% with 2% absolute precision. The principal and faculty of each school were explained the purpose and method of study. Children from class 5th to 11th standard (three sections) of Delhi school were enrolled through simple random sampling. In other two schools, children of all class sections from 5th to 11th standards in 10 to 17 year age group, present on the day of study, were enrolled. Children were arbitrarily grouped into lower ( $\leq$  Rs 10,000 per month) and higher ( $>$ Rs 10,000) family income groups as most of the children belonged to well to do families. To study the effects of age in getting a

physician label of asthma, 10 to 17 year age group children were further divided into younger (10 to 13 years) and older (14 to 17 years) age groups.

Questionnaires in English language were distributed to 1000 school children. 900 valid questionnaires were received for analysis. Profoma I comprised of questions regarding the personal details of the child, their anthropometric measurements, environmental and social factors. Profoma II comprised of questions on child's physical activity at school, any long absence of the child due to complaints of asthma like symptoms noticed by class teacher. Profoma III contained medical details relating to symptoms suggestive of asthma, such as history of recurrent cough, and/or wheezing and/or shortness of breath in last one year or any time in the past other than last one year. Questions regarding, factors associated with asthma such as rhinitis, sneezing, atopy to food, smoke, dust or pollen, drug history, history of physician diagnosis of asthma, family history of asthma or similar complaints were also asked. Proforma I and III were answered by the parents and proforma II by their respective class teachers.

General physical and systemic examination was done, followed by pulmonary function test. Peak expiratory flow rates were measured by Mini-Wright peak flow meter in standing position. Best of three measurements was taken. Children who had asthma-like symptoms were subjected to spirometry examination. A flow volume loop was obtained using Ocean Winspiro version 2.36B-16 bit, Oceans.r.l,roma,italica. Forced expiratory volume in one second ( $FEV_1$ ) and forced vital capacity (FVC) were measured.  $FEV_1/FVC$  values less than 80% with normal FVC was taken to indicate airway obstruction. Reference values for North Indian population were used(13).

Based on the questionnaire response, asthma was defined as children having cough and/or wheeze and/or shortness of breath. These children were grouped as having asthma-like symptoms (ALS). For the present analysis, children having ALS were further divided into two groups, based on a similar study by Siersted, *et al.* done on Odense children(3). Those who had ALS and answered yes to the question 'have you been

diagnosed asthmatic by doctors' were grouped as labeled (physician diagnosed) asthmatics. Those children who had ALS and obstructive/normal flow volume loops (spirometry test) in the absence of physician diagnosed asthmatics were grouped as unlabeled asthmatics.

The data was analyzed on SPSS version 10.0 (Statistical package for social sciences) software. Chi-squared or Fisher's exact test was applied to test the significance of association of different factors between the two groups. Odds ratios (OR) were calculated for various factors studied. The association of factors was assessed at 5% level of significance. The evaluation of independent risk factors was done by multiple logistic regression analysis.

## Result

Among 900 school children, 140 (15.5%) had asthma like symptoms. Among 140 ALS cases, 25 (17.8%) were physician diagnosed or labeled asthmatics and 115 (82.2%) as unlabeled asthmatics. The association of various factors with labeled versus unlabeled asthmatics were assessed. We found that majority of females having ALS were not labeled as asthmatics by the physician as compared to males (68% vs 34%,  $p = 0.002$ ). All labeled asthmatics and 74% of unlabeled asthmatics belonged to 10 to 13 year age group ( $p < 0.004$ ). Cough was found to be equally prevalent in labeled and unlabeled asthmatics whilst those having wheezing (88% vs 30%,  $OR = 16.8$ ,  $p = 0.0001$ ) and shortness of breath (92% vs 48%,  $OR = 12.6$ ,  $p = 0.0001$ ) were more often labeled as asthmatics by the physician. Children having rhinitis ( $OR = 0.30$ ,  $p = 0.05$ ) were more likely not labeled as asthmatics by their physician. The other factors studied were not found to have any significant difference between both the groups (*Table I*). On stepwise (forward) multiple logistic regression analysis, wheezing ( $OR = 9.2$ ;  $p = 0.018$ ) and shortness of breath ( $OR = 10.1$ ;  $p = 0.026$ ) were found to be the independent significant factors. Among ALS children, 26 (18.5%) showed obstruction in the spirometry test, 106 (75.7%) had normal test and 8 (5.8%) had unacceptable test. 24% of the labeled asthmatics and 17.4% of unlabeled ones showed obstructive

**TABLE I**—Comparison of Labeled with Unlabeled Asthmatics

Variable	Labeled (n = 25)		Unlabeled (n = 115)		OR	(p value)
	No	(%)	No	(%)		
1 Sex					4.14	(0.002)
Male	17	(68)	39	(34)		—
Female	8	(32)	76	(66)		—
2 Age (yr.)						(0.004)
10 to 13	25	(100)	85	(74)		—
14 to 17	0	(0)	30	(26)		—
3 Cough	25	(100)	115	(100)		—
4 Wheezing	22	(88)	35	(30)	16.8	(0.0001)
5 Shortness of breath (SOB)	23	(92)	55	(48)	12.6	(0.0001)
6 Physician labeled bronchitis	16	(64)	55	(48)	1.9	(0.14)
7 Family History of similar complaint	8	(32)	28	(24)	1.5	(0.42)
8 Labeled asthmatic in family	3	(12)	18	(15)	0.73	(0.76)
9 Pets	2	(8)	23	(22)	0.35	(0.25)
10 Carpets	10	(40)	38	(33)	1.4	(0.51)
11 Angithi / Stove	6	(24)	16	(14)	1.95	(0.23)
12 Passive smoking	9	(36)	41	(35)	1.02	(0.97)
13 Dry method of cleaning	5	(20)	39	(34)	0.49	(0.17)
14. Family Income (per month)						
≤ Rs. 10,000	6	(24)	22	(19)	0.75	(0.58)
> Rs.10,000	19	(76)	93	(81)		
15. Presence of rhinitis	3	(12)	36	(31)	0.30	(0.05)

flows in spirometry test ( $p$  vs  $< 0.001$ ).

### Discussion

In this study substantial under diagnosis of asthma in children was confirmed by subjective and objective criteria. For every labeled asthmatics there were 4.5 unlabeled ones (2.8 % vs 12.7%). Wheezing and shortness of breath was found more in the labeled asthmatics as compared to the unlabeled ones ( $p < 0.05$ ) while cough was equally prevalent in both the groups. In the study done by Siersted, *et al.* on Odense school children(3), authors found that the undiagnosed asthmatics comprised one third of the diagnosed ones. They found that cough was equally prevalent in the diagnosed and the undiagnosed subjects (58% vs 58%) but the latter group

reported less breathing trouble (100% vs 50%,  $p < 0.001$ ) and wheezing (96% vs 34%,  $p < 0.001$ ). Similar observations were made by the workers in other studies(1-4, 9,10). This probably suggests that physicians tend to label and diagnose asthma more often when they notice wheezing or shortness of breath, rather than cough alone. We found that females were over-represented among unlabeled asthmatics and under-represented among labeled ones. Reason may be gender bias and resistance by the parents to get female child a label of asthma by the physician. Children having rhinitis (OR = 0.30,  $p = 0.05$ ) were higher in proportion among the unlabeled asthmatics as compared to the labeled ones. There are studies(14,15) suggesting frequent coexistence of asthma and allergic rhinitis and also allergic rhinitis precedes asthma and is its risk factor. Children having

### What this Study Adds

- For every labeled asthmatic, there are 4.5 unlabeled asthmatics. Children having repeated cough but no wheezing or breathlessness are more likely to remain unlabeled and under treated.

rhinitis were often not given the correct diagnosis despite treatment by the doctors. In the Odense stud(3), underdiagnosis of asthma was independently associated with low physical activity, passive smoking, serious family problems and absence of rhinitis.

In conclusion, we found that asthma is more likely to be missed or under diagnosed in children presenting with cough without wheezing and shortness of breath.

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