Prevalence of asthma in urban and rural children in Tamil Nadu

SHIBI CHAKRAVARTHY K., RAJ B. SINGH, SOUMYA SWAMINATHAN, P. VENKATESAN

ABSTRACT

Background. There are very few community-based studies on the prevalence of asthma in Indian children. We aimed to estimate the prevalence of asthma in children under 12 years of age and to study possible differences in the prevalence of childhood asthma in urban and rural areas of Tamil Nadu.

Methods. A total of 584 children from Chennai and 271 children from 25 villages around Chennai formed the urban and rural groups, respectively. From November 1999 to February 2000, data were collected using a simplified version of the ISAAC questionnaire, which was administered by trained students. Symptoms suggestive of asthma or hyperreactive airways disease in children under 12 years of age were recorded from the selected urban and rural populations by questioning the parents. The results were analysed separately for children 0–5 and 6–12 years of age.

Results. Of the 855 children studied, the overall prevalence of breathing difficulty (including asthma) was 18% and the prevalence of 'diagnosed' asthma was 5%. Twenty-two per cent of urban and 9% of rural children 6–12 years of age reported breathing difficulty 'at any time in the past' ($p<0.01$). A significantly higher proportion of 6–12-year-old urban children also reported nocturnal dry cough (28.4% v. 18.7%, $p<0.05$). Urban children reported recent wheeze more often than rural children (92% v. 77%, $p=0.01$).

Conclusions. Symptoms suggestive of asthma were present in 18% of children under 12 years of age. Though the prevalence of diagnosed childhood asthma was about 5% in both urban and rural areas, the prevalence of 'breathing difficulty' and nocturnal cough was significantly higher among urban children in the age group of 6–12 years. Children living in urban areas also reported 'recent wheeze' more often than rural children. Our data suggest that the actual prevalence of asthma and other 'wheezy' illnesses may be higher than that previously documented. Further studies are needed to confirm the difference in prevalence between urban and rural children and also to identify possible causes that could account for the higher urban prevalence of asthma in Tamil Nadu.

Natl Med J India 2002; 15:260–3.

INTRODUCTION

Asthma in childhood is a chronic disease and, when severe, often results in increased morbidity for the patient and indirect economic losses for the community. Currently, much attention is being given to the rise in prevalence of childhood asthma worldwide.[1,2] The basis for the increase is not known. A number of studies have examined the various factors involved such as preva-

Tuberculosis Research Centre (ICMR), Mayor V. R. Ramanathan Road, Chetput, Chennai 600031, Tamil Nadu, India
SHIBICHAKRAVARTHY K., SOUMYA SWAMINATHAN HIV/AIDS Department
P. VENKATESAN Statistics Deparhnent
Apollo Hospitals, 21, Greams Lane, Chennai 600006, Tamil Nadu, India
RAJ B. SINGH Department of Respiratory Medicine
Correspondence to RAJ B. SINGH, S 82, Anna Nagar, Chennai 600040 *rajbsingh@hotmail.com*

lence of atopy in a region, allergen exposure, early and recurrent respiratory viral infections in childhood, poverty, diet and obesity, number of siblings in the household, indoor ozone levels, and racial, geographic and socioeconomic differences.[3-10] Though many of these factors have been associated with an increase in the severity of asthma, the extent to which they contribute to the development of asthma is still not clear.

The recent International Study of Asthma and Allergies in Childhood (ISAAC) and European Community Respiratory Health Survey (ECRHS)[11] have not only produced some information about the prevalence rates of asthma in low-income countries, but also provided a well-validated and easily reproducible method for conducting further studies on the prevalence of asthma. However, there are very few community-based studies on the prevalence of asthma in Indian children and these have given conflicting results.[12-15] We estimated the prevalence of asthma in children <12 years of age and possible differences in prevalence to asthma between urban and rural areas of Tamil Nadu, south India.

METHODS

The study was conducted in 25 villages in and around the townships of Uthirameroor, Karunguli and Madhuranthakam in Chengalpattu district of Tamil Nadu and 5 low-income urban areas (Periamet, Egmore, Chintadaripet, Pallavan Salai and Koyambedu) of Chennai city. The investigators were well-trained students of the Sociology Department of Madras Christian College, Chennai. A questionnaire based on the one used in the ISAAC study was used with some modifications to make it simpler, retaining only those questions that were related to asthma. The questionnaire had been translated into Tamil and validated at the time the ISAAC survey was conducted in Tamil Nadu a few years ago; the same questionnaire was used.

A door-to-door survey was conducted at a time when all the family members were expected to be at home. Everybody in the community who could be met and interviewed within a time-frame was included. Self-reported answers by parents of children <12 years of age were used to collect the required information. The response rate was 92%. No clinical examination was done to confirm the diagnosis (see Box for the questionnaire).

The English version of the questionnaire

1. Has your child at any time in the past had any difficulty in breathing or while breathing made any whistling sound in the chest? Yes/No*
2. Did you hear a wheezing or whistling sound during breathing in your child over the past 12 months? Yes/No*
3. How many episodes of wheezing were there during the past 12 months? ( ) <4 episodes ( ) m4 episodes
4. Is there any disturbance of sleep in your child due to wheezing for the past 12 months? ( )< one night/week ( ) >one night/week
5. During episodes of severe wheezing during the past has your child been unable to speak? Yes/No
6. Has your child had asthma at any time? Yes/No
7. During the past 12 months when your child exercises or after exercise did you notice any wheezing sound? Yes/No
8. During the past 12 months has your child had any dry cough (other than during a cold or infectious disease) during night? Yes/No
9. Is there any asthma patient in your family? Yes/No
10. Has asthma affected your child's activity? Yes/No

* Only persons who answered 'Yes' to questions 1 and 2 were asked questions 3, 4 and 5. All others moved on directly to question 6.

Statistical methods

Univariate analysis was carried out separately for each factor (question). The results were analysed using 2-way and 3-way contingency tables for age, sex and residential status. Chi-square tests of significance were carried out to test for differences between proportions. Significance was reported at 5% level. The standardized rates were calculated using direct standardization methods.

RESULTS

A total of 855 children were studied from November 1999 to February 2000. The distribution of these children according to age, sex and place of residence is given in Table I. There were 584 children from urban and 271 from rural areas and the sex distribution was similar in both the groups.

Overall prevalence of respiratory symptoms

Table II shows the overall prevalence of reported symptoms. There was a high prevalence of breathing difficulty and nocturnal dry cough among the children studied. Breathing problems including wheeze at some time in the past were reported by 18% and reported nocturnal dry cough by 21%, though a definite history of asthma was elicited only in 5%. About 18% of children had wheezing episodes during the past 12 months. Exercise-induced wheezing was reported by 7% and a family history of wheezing illness was present in 5% of children.

Urban–rural differences

Table III shows the comparison of reported respiratory symptoms between children from urban and rural areas. Among the 0–5-year-old children there was no significant difference in response to any of the questions between the urban and rural areas. However, among 6–12-year-old children, breathing difficulty (22% *v.* 9%, $p<0.01$) and nocturnal dry cough (28% *v.* 19%, $p<0.05$) were

TABLE I. Distribution of children according to demographic characteristics

Population	Age group (Years)	Total	Percentage of children	
			Boys	Girls
Urban	0–5	304	52	48
	6–12	280	55	45
	0–12	584	53	47
Rural	0–5	137	47	53
	6–12	134	51	49
	0–12	271	49	51
Total	0–12	855	52	48

TABLE II. Overall prevalence of symptoms and severity of asthma in all children *(n=855)*

Symptoms of asthma	Prevalence	
	n	%
Breathing difficulty at any time in the past	153	17.9
Wheezing during the past 12 months	152	17.7
Frequency >4 episodes in the past 12 months	26	3.0
Sleep disturbance >one night per week due to wheezing	22	2.6
Speech disturbance during wheezing	58	6.8
Diagnosed asthma	43	5.0
Exercise-induced wheezing	59	6.9
Nocturnal dry cough	177	20.7
Family history of asthma	138	16.1
Reduced physical activity due to asthma	41	4.8

TABLE III. Reported prevalence of respiratory symptoms in urban and rural children.

Symptoms of asthma	0-5 years		6-12 years	
	Urban (n=361)	Rural (n=137)	Urban (n=208)	Rural (n=134)
Breathing difficulty at any time in the past	17.1	19.7	22.1*	9*
Diagnosed asthma	5.3	4.4	5.4	4.5
Exercise-induced wheezing	6.9	8.0	6.4	6.8
Nocturnal dry cough	22.8	19.0	28.4*	18.7*
Family history of asthma	16.5	13.8	16.1	17.8
Reduced physical aaivity due to asthma	4.6	5.1	4.3	6.0

All values are percentages *p<0.05

TABLE IV. Severity and frequency of wheezing episodes in urban and rural children

Symptoms of asthma	Urban (n=114)	Rural (n=39)
Wheezing during the past 12 months	92*	77*
Frequency >4 episodes in the past 12 months	15	23
Sleep disturbance >one night per week due to wheezing	11	23
Speech disturbance durin ringwheezing	39	31

* p=0.01

reported more frequently by urban children than by those living in rural areas. There was no significant difference in the prevalence of diagnosed asthma, exercise-induced wheezing, family history of asthma or reduced physical activity due to asthma between rural and urban children.

Table IV shows the responses given by all those who said 'yes' to the first question. The age groups have been combined as the numbers were small. These children were asked for a specific history of symptoms indicating the severity of asthma such as wheezing during the past 12 months, frequency of episodes and sleep or speech disturbance due to wheezing. Recent wheeze (within the past 12 months) was more common in urban children compared to rural children (92% *v.* 77%, p=0.01). There was no difference in the severity of asthma, based on frequency of >4 episodes of wheeze in 12 months, between urban and rural children. There was also no difference in the occurrence of speech or sleep disturbance due to wheezing in children in both the groups.

DISCUSSION

We used a simplified questionnaire based on the ISAAC model, which could detect broad differences in respiratory symptoms, particularly symptoms of asthma, in children 0–12 years of age. The questionnaire had been validated and used to study asthma prevalence in many areas of the world.

We found that 'breathing difficulty associated with whistling sounds in the chest' occurred in about 18% of children surveyed and almost the same number reported wheezing in the past 12 months. Nocturnal cough, another symptom suggestive of asthma was also fairly common (21%), further suggesting that this was a true phenomenon. Our data suggest that wheezing-associated illnesses are more common in children in south India than previously thought. A study in Bangalore revealed that the prevalence of asthma in children <18 years increased steadily from 9% in 1979 to 29.5% in 1999.[12] The rise in prevalence correlated with demographic changes in the city such as increase in the number of industries, density of population and number of automobiles.

The current belief, based mainly on the recent questionnaire-based surveys, is that asthma is more common in western Europe, North America and New Zealand compared to countries such as India and China. This conclusion has been drawn from very few studies done in countries such as India. More such studies are required, on a larger scale, to get a clear picture of the current scenario since the large sizes and complexities of countries such as India and China make it difficult to draw conclusions or extrapolate from a few surveys done in just a few cities.

Our study also reveals an increased prevalence of the symptom complex suggestive of asthma in urban children 6–12 years of age, compared to rural children of the same age and socioeconomic status. However, no rural-urban difference was detected in the younger age group. In younger children, lower respiratory tract viral infections are often associated with cough and wheezing. These diminish markedly by the age of 5-6 years and wheezing beyond that age is generally due to asthma. Our findings are corroborated by a few other recent surveys. Paramesh[12] found that among children 6–15 years of age, the prevalence of asthma in urban children was 16.6% while in rural children it was 5.7%. Among urban children, a higher prevalence of asthma was found among children exposed to heavy traffic, thereby acknowledging the presence of outdoor air pollution as a triggering factor.

Other studies done in north India have reported a prevalence of asthma of 11.6% in Delhi (urban)[15] and 1% in rural children in Punjab.[14] Gupta *et al*[13] found that respiratory symptoms were reported by 31% of 9–20-year-old children but the observed asthma prevalence was 2.6% for boys and 1.9% for girls in Chandigarh.[13] Hence, there is a wide variation in reported asthma prevalence from different parts of the country, but few studies have investigated rural and urban differences.

Various researchers around the world are investigating causes for the early development of asthma in childhood. One such study by Celedon *et al*[16] from Costa Rica showed that sensitization to house dust mites, low parental education and parental history of asthma were associated factors. Stewart *et a1.*[17] attempted to correlate per capita gross national product (GNP) and the prevalence of asthma. They found a positive association between per capita GNP and wheeze in the past 12 months in the 13–14 years age group, but not in the 6–7 years age group. Yemaneberhan *et al.*[18] studied the frequency of wheeze, chronic cough and atopy in children from urban and rural Ethiopia and showed that there is a positive correlation between urbanization and the development of childhood asthma. Similarly, Addo Yobo *et a1.*[19] have studied the prevalence of exercise-induced bronchospasm in urban and rural school-going children from Ghana. They have reported a higher prevalence of exercise-induced bronchospasm in the 'urban rich' group as compared to both 'urban poor' and 'rural' groups. Another study from India that has compared urban–rural differences found a higher prevalence of asthma in urban children.[12]

Urbanization could mean a number of lifestyle changes, such as change in dietary habits, indoor allergen exposure, pollution, crowding, etc. So far, no single factor has been shown to have a strong correlation with the prevalence of asthma. Studies have suggested that exposure to environmental tobacco smoke,[13] a family history of atopy[20] and pets at home[21] are risk factors associated with symptoms of asthma.

In summary, our data suggest that breathing difficulty associated with wheezing is a common symptom, occuring in approximately 1 in 5 children <12 years of age. Our findings suggest that asthma may be more common than previously believed and that symptoms suggestive of asthma are more common among urban

compared to rural children of school-going age in south India. Though this survey has brought out significant differences between urban and rural children in respiratory symptomatology suggestive of asthma, these are only preliminary. Other limitations of this study are that the population was not randomly selected and represented mainly the lower socioeconomic group. Further, any questionnaire-based survey has limitations due to differences in comprehension of the questions by the respondents. The diagnosis of asthma was also not clinically confirmed in our study. Larger studies are required to confirm our findings and explore possible reasons for the differences in prevalence of asthma between urban and rural south Indian children.

ACKNOWLEDGEMENTS

We thank Mrs Nalini Manuel from 'ASHA' and the team of students from the Sociology Department of Madras Christian College for conducting the survey. We would like to express our gratitude to Mrs Anderson of the Asthma Foundation of India for data entry and secretarial assistance.

REFERENCES

1 Asher MI. Keil U, Anderson HR, Beasley R Crane J, Martinez F, *et al*. International Study of Asthma and Allergies in Childhood (ISAAC): Rationale and methods. *Eur Respir J* 1995;8:483–91.
2 The International Study of Asthma and Allergies in Childhood. ISAAC Steering Committee. Worldwide variation in prevalence of symptoms of asthma, allergic rhinoconjunctivitis and atopic eczema: ISAAC. *Lancet* 1998;351: 1225–32.
3 Faniran AO, Peat JK, Woolcock AJ. Prevalence of atopy, asthma symptoms and diagnosis, and the management of asthma: Comparison of an affluent and a non-affluent country. *Thorax* 1999;54;606—10.
4 McIntosh K,Ellis EF HoffmanLS,LybassTG,EllerJJ,FulginitiVA. The association of viral and bacterial respiratory infections with exacerbations of wheezing in young asthmatics. *J Pediatr* 1973;82:578–90.
5 Rona RJ. Asthma and poverty. *Thorax* 2000,55:239–44.
6 Figueroa-Munoz JI, Chinn S, Rona RJ. Association between obesity and asthma in 4–11year old children in the UK. *Thorax* 2001;56:133—7.
7 RonaRJ,HughcsJM,ChinnS.Association between asthma and family size between 1977 and 1994. *J Epidemiol Community Health* 1949;53:15—19.
8 Mortimer KM. Tager IB, Dockery DW, Neas LM, Redline S. The effect of ozone on inner city children with asthma:Ideatification of susceptible sub-groups. *AmJRespir Crit Care Med* 2000,162:1838–45.
9 PatridgeMR.In what way may race,ethnicity or cnlture influence asthma outcomes? *Thorax* 2000;55:175-6.
10 Duran-Tauieria E,Rona RJ.Geographical and socioeconomic variation in the prevalenae of asthma symptoms in English and Scottish children. *Thorax* 1999,54:476–81.
11 ChowguleRV,ShetyeVM,ParmarJR,BhosaleAM,Khandagale MR,PhalnitkarSV. *et al*. Prevalence of respiratory symptoms, bronchial hyperreactivity, and asthma in a mega city: Results of the European community respiratory health survey in Mumbai (Bombay, India). *Am J Respir Crit Care Med* 1998;158:547–54.
12 Paramesh H. Epidemiology of asthma in India. *Zndian J Pediarr* 2002:69;309–12.
13 Gupta D, Aggarwal AN, Kumar R, Jindal SIC. Prevalence of bronchial asthma and association with environmental tobacco smoke exposure in adolescent school children in Chandigarh, north India. *J Asthma* 2001:38:501–7.
14 Singh D, Arora V, Sobti PC. Chronic/recurrent cough in rural children in Ludhiana, Punjab. *Indian Pediatr* 2002;39:23—9.
15 Chhabra SK, Gupta CK. Chhabra P, Rajpal S. Prevalence of bronchial asthma in school children in Delhi. *JAsthma* 1998:35:291-6.
16 CeledonJC,Soto-QuirosME,SilvermanEK,HansonLA,WeissST.Risk factors for childhood asthma in Costa Rica. *Chest* 2001;120;785–90.
17 Stewart AW, Mitchell EA, Pearce N. Strachan DP, Weilandon SK. The relationship of percapita gross national product to the prevalence of symptoms of asthma and other atopic diseases in children (ISAAC). *Int J Epidemiol* 2001;30:173–9.
18 Yernaneberhan H, Bekele Z Venn A, Lewis S, Parry E, Britton J. Prevalence of wheeze and asthma and relation to atopy in urban and rural Ethiopia. *Lancet* 1997:350;85—90.
19 Addo Yobo EOD, Custovice A, Taggart SCO, Asafo-AgyeiAP, Woodcock A. Exercise induced bronchospasm in Ghana: Differences in prevalence between urban and rural schoolchildren. *Thorax* 1997;52:161–5.
20 ChhabraSK,Gupta CK,Chhabra P, Rajpal S. Risk factors for development of bronchial asthma in children in *Delhi.Ann Allergy Asthma immunol* 1999:83:385—90.
21 PokharelPK,KabraSK,KapoorSK.Pandey RM. Risk factors associated with bronchial asthma in school going children of Haryana. *Indian J* Pediatr 2001;68: 103-6.