Original Article

Asthma in Rural Bangladeshi Children

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ABSTRACT

Objective. Although bronchial asthma causes a great deal of morbidity among children in Bangladesh, few epidemiological studies addressed this problem. The study aims to determine the prevalence of wheezing and its association with environmental and host factors.

Methods. A total of 1587 children aged 60-71 mth living in 50 villages in rural Bangladesh at Matlab was studied. Trained field workers interviewed caretakers of these children to diagnose wheezing using an adopted questionnaire of the International Studies of Asthma and Allergies in Childhood (ISAAC). History of pneumonia among wheezing and non-wheezing children during their childhood was obtained from the surveillance records.

Results. The prevalence of wheezing in the last 12 mth prior to survey was 16.1% (95% CI: 14.3%, 18.0%), significantly higher among children who had attacks of pneumonia during their infancy compared to children who did not (23.0% *vs* 14.6%, p< 0.0001). Risk factors associated with wheezing were pneumonia at ages 0-12m (OR= 1.50, 95% CI 1.08, 2.10) and 13-24m (OR= 2.12, 1.46, 3.08), maternal asthma (OR=3.01, 95% CI 2.02, 4.47), paternal asthma (OR= 3.12, 95% CI 1.85, 5.26), maternal eczema (OR=1.81, 95% CI 1.14, 2.87) and family income ≤ 100 US$ (OR for US$ 51-99= 1.63, 95% CI 1.05, 2.53; OR for US$ ≤ 50= 2.12, 95% CI 1.31, 3.44).

Conclusion. Our results suggest that wheezing is a significant cause of morbidity among children in rural Bangladesh. Greater efforts are needed to prevent pneumonia among children during their infancy to reduce the chances of subsequent development of wheezing. **[Indian J Pediatr 2007; 74 (6) : 539-543]** *E-mail: kzaman@icddrb.org*

Key words : *Asthma; Wheezing; Pneumonia; Bangladesh*

Several cross-sectional studies conducted over the past 20-30 yr indicate an increased prevalence of allergic respiratory diseases worldwide, particularly among children in "western" countries.[1-4] It has been observed that wide variations exist between countries in prevalence of asthma, its clinical presentation, and natural history.[5] The differences of the prevalence between countries were 20 to 60-fold and were more within developing countries than in developed countries.[5] The prevalence was also different between areas in a single country. Asthma was the second leading cause of death in Bangladesh in 2000 according to Bangladesh Bureau of Statistics.[6] A nationwide prevalence survey in Bangladesh among populations aged 5 yr and above revealed that the overall prevalence of recent wheeze (within last 12 mth) was 6.9%.[7] The prevalence was more among children compared to adults (7.3% *vs* 5.3%). Another study using the questionnaire of International Study of Asthma and Allergies in Childhood (ISAAC) in urban and rural schools in Dhaka district in Bangladesh showed that the prevalence was 9.1% among 6-7 yr old and 6.1% among 13-14 yr old children.[8] The prevalence was higher among male children compared to females.

Risk factors for the development of asthma may be divided into several categories such as allergic sensitization or exacerbation. These include hereditary atopy, early exposure to protein antigens such as cow's milk or egg white, recurrent respiratory tract infections and indoor and outdoor environmental factors.[5,9]

Respiratory infections have long been recognized as precipitating factors in asthma.[10] It has been reported that

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the history of pneumonia in early life is strongly associated with bronchial asthma.[11] The incidence of wheezing is greatest in the first few yr of life,[12] children with hereditary atopy/asthma and acute lower respiratory infections (ALRI) caused by respiratory syncital virus (RSV) was associated with increased risk of subsequent allergic sensitization.[13]

Since there is a paucity of epidemiological data on wheezing in children in Bangladesh, we conducted a community-based study in rural Bangladesh to determine the prevalence of wheezing and its association with environmental and host factors and to examine whether ALRI during infancy contributes to subsequent development of wheezing.

MATERIALS AND METHODS

The study was conducted in rural Matlab, Bangladesh where the International Centre for Diarrheal Disease Research, Bangladesh (ICDDR,B) has been maintaining a field research project since 1963. Matlab is a low-lying riverine area, which is located 45 km south east of Dhaka, the capital of Bangladesh. The principal occupations of Matlab residents are farming and fishing. Since 1966 a Health and Demographic Surveillance System (HDSS), which consists of regular cross-sectional censuses and longitudinal registration of vital events, has been maintained in the area.[14] A central treatment facility, staffed by physicians and paramedics provides free therapy for 12,000-15,000 diarrhea patients a yr. A Maternal, Child Health and Family Planning Program (MCH-FP) has been in operation for half of the population of the HDSS area (current population of HDSS is about 210,000) since 1978 and intensive research has been conducted in this population.[15] The other half serves as a comparison area where regular government health care facilities are available. Each community health research worker (CHRW) in the intervention area covers a population of about 1800. She visits each household monthly and is responsible for recording of respiratory and diarrheal illnesses of children, recording of vital events, immunization to children and referral of severely sick children and mothers *etc.*

Subjects and Sampling

A total of 50 villages was randomly selected from 67 villages from the intervention area of Matlab HDSS. All children aged 60-71 mth living in those villages were included in the study. The study was explained to the caretakers of the children and asked if they agreed to participate. Information about episodes of pneumonia in the first and second yr of life was taken from the records of HDSS. During the monthly visit the CHRWs enquire all children < 5 yr about the signs and symptoms of pneumonia using one mth recall. Based on history of fever, hurried respiration and chest indrawing, pneumonia was diagnosed and graded as mild or severe. Height and weight of all children were measured to the nearest scale of 1 cm and 100 gm respectively.

The study was conducted between June and October 2001.

The sample size was calculated on the assumption that about 10% children aged 60-71 mth would have wheezing at this population at the time of survey (Takeuchi H, personal communication). To estimate this level of prevalence with ± 1.5% precision and 95% confidence limit and 5% losses we need a population of 1600. The calculated sample size has been multiplied by 2 to allow stratified analysis.

Questionnaire, Interview

The mothers/caretakers of these children were asked a questionnaire which included socio-economic information and any wheezing during the last 12 mth, indoor air pollution (when parents smoke inside the house or cooking is done within the room) and parents' asthma and eczema. Maternal and paternal asthma was diagnosed through interview. There is a local terminology (hapani) of asthma and people realize it. Diagnosis of wheezing in children was done using the adopted questionnaire of International Studies of Asthma and Allergies in Childhood.[5] ISAAC questionnaire contains several questions on various wheezing symptoms of bronchial asthma. We used the question "Has your child had wheezing or whistling in chest in the last 12 mth"? Monthly income of the family from various sources was ascertained through questions.

Statistical Analysis

Data were entered using the software package FoxPro (Microsoft corp.) and analysed by the STATA statistical software (Release 8.0, Stata Corporation, College Station, Texas, 2003). Continuous variables such as height, weight, monthly income were compared by t-test or Mann-Whitney test. Categorical variables were tested by χ^2 test. Odds ratios for current-wheezing for the independent variables were calculated in a logistic regression model adjusted for mother's education and father's education.

The study was approved by the Ethical Review Committee of ICDDR,B.

RESULTS

The prevalence of wheezing among children aged 60-71 mth during 12 mth prior to survey was 16.1% (95% CI: 14.3%, 18.0%), (255/1587, $X^2 = 11.57$) (Table 1). The sociodemographic characteristics of study children with and without wheezing and their caretakers are presented

Table 1. Comparison of Characteristics between Children with and without Wheezing

	Children with wheezing (n=255)	Children without wheezing (n=1332)	All (n= 1587)	P value *
Age (mth)	68.4 ± 3.2	68.0 ± 3.4	68.1 ± 3.3	0.08
Sex- Male (%)	51.0	51.0	51.0	0.95
Number of <5 children in the household				
0	45.4	44.5	44.7	0.88
1	47.8	48.0	48.0	
≥ 2	6.7	7.5	7.4	
Weight (Kg) (mean ± SD)⁺	14.6 ± 1.9	14.9 ± 1.8	14.8 ± 1.9	0.02
Height (cm) (mean ± SD)⁺	102.8 ± 4.9	103.7 ± 5.1	103.6 ± 5.1	0.01
Education of mother (years of schooling) (mean ± SD)	2.8 ± 3.1	3.5 ± 3.6	3.4 ± 3.6	0.001
Education of father (years of schooling) (mean ± SD)	4.3 ± 7.3	5.6 ± 10.6	5.4 ± 10.1	0.01
Monthly income (mean ± SD) (US $)	72 ± 62	86 ± 80	84 ± 77	0.001
Smoke inside the house (%)	51	52	52	0.74
No of rooms in the house (mean)	2.2	2.3	2.3	0.07
Mother's asthma (%)	19.2	6.8	8.8	0.000
Father's asthma (%)	11.3	3.3	4.6	0.000
Mother's eczema (%)	12.1	6.6	7.5	0.003
Father's eczema (%)	12.1	6.6	7.5	0.003

*Comparison between children with and without wheeze, ⁺n= 1495

in Table 1. About 51% of children were male. Children without wheezing had higher weight and height compared to wheezing children.

The monthly income and parenteral education was lower among households with wheezing children compared to non- wheezing children. Parents of wheezing children were suffered more with asthma and eczema.

Prevalence of wheezing was significantly higher among children who had attacks of pneumonia during their infancy (23.0% *vs* 14.6%, p< 0.0001) compared to children who did not (Table 2).

Table 2. Distribution of Children with Wheezing and Pneumonia during their Infancy

Children with wheezing	Pneumonia during infancy*		Total
	Yes	No	
Yes	66 (23.0%)	189 (14.6%)	255
No	221 (77.0%)	1104 (85.4%)	1325
Total	287	1293	1580

* during 0-11 months of age
X^2= 11.57, p< 0.0001

Risk factors associated with wheezing were pneumonia at ages 0-12m (OR= 1.50, 95% CI 1.08, 2.10) and 13-24m (OR= 2.12, 1.46, 3.08), maternal asthma (OR=3.01, 95% CI 2.02, 4.47), paternal asthma (OR= 3.12, 95% CI 1.85, 5.26), maternal eczema (OR=1.81, 95% CI 1.14, 2.87) and family income ≤ 100 US$ (OR for US$ 51-99= 1.63, 95% CI 1.05, 2.53; OR for US$ ≤ 50= 2.12, 95% CI 1.31, 3.44) (Table 3). Education of parents, passive smoking with tobacco were not associated with occurrence of asthma (data not shown).

DISCUSSION

The prevalence of wheezing among children aged 60-71 mth during 12 mth prior to our survey was 16.1%. This

Table 3. Logistic Regression Analyses to Predict Factors Associated with Wheezing (n=1571)

Dependent variable	Independent variables*	Odds ratio	95% CI	P value
Wheezing	Maternal asthma	3.01	2.02, 4.47	0.00
	Paternal asthma	3.12	1.85, 5.26	0.00
	Pneumonia 0-12 m	1.50	1.08, 2.10	0.01
	Pneumonia 13-24 m	2.12	1.46, 3.08	0.00
	Maternal eczema	1.81	1.14, 2.87	0.01
	Paternal eczema	1.53	0.96, 2.43	0.06
	Family income monthly (US$)			
	≥ 100	1.00		
	51-99	1.63	1.05, 2.53	0.02
	≤ 50	2.12	1.31, 3.44	0.00

Adjusted for mother's education, father's education
*reference category – No maternal asthma, no paternal asthma, no pneumonia during 0-12 months, no pneumonia 13-24 months, no maternal eczema, no paternal eczema

rate was much higher than the rate observed in an earlier study conducted among school children in 2000 in urban and rural areas in Dhaka district.[8] The age group was different from our study and it was limited to school children. Contrary, we conducted this study among all children aged 60-71 mth living in 50 villages in rural Bangladesh. We found that the children had higher risk for wheezing who suffered pneumonia at ages 0-23 mth. Our study was conducted in an area where the incidence of acute respiratory infections (ARI), diarrhea and malnutrition was high.[16] The incidence of ARI and diarrhea among children < 5 yr of age was 5.5 and 4.6 episodes per child per year respectively in this area.[17,18]

Among various infectious agents during early life, respiratory syncital virus (RSV) is well known to cause recurrent wheezing and bronchial hyperresponsiveness in later life.[19-21] We did not examine the etiologic agents in our study and a majority of episodes might be due to RSV since a Bangladeshi study reported that RSV was the commonest virus detected from children <2 yr of age hospitalized due to severe lower respiratory tract infections and diarrhea.[22] Studies have reported that RSV and asthma are linked to imbalance of Th1/Th2 type immunity induced by the virus,[23-25] although the cause and effect relationship of RSV to atopic predisposition is conflicting.[19-21, 26] Despite controversy about the relationship between RSV and atopy, the association itself is important from clinical and public health point of view, because under-diagnosis and under-treatment exacerbates asthma.

Acute lower respiratory infections (ALRI) are major cause of morbidity and mortality in Bangladesh and improved management of childhood illnesses successfully decreased death from pneumonia among young children.[17,27] These children have higher risk of developing wheezing in subsequent yr and proper management is required. Rhinovirus, a causative agent of common cold, is related to exacerbations of asthma attacks in 80% of children and 50% of adults,[28-30] although their role in causing ALRI is not fully known. The results of the present study are compatible with these observations, indicating the need for attention to post ALRI wheezing to curve the increase of wheezing in children.[21,30,31]

Several limitations of the study should be noted. Whereas ISAAC questionnaire was developed for 6-7 yr-old school children, we administered it to 5-yr-old in the community. This was because that they were the oldest children whose complete records of pneumonia since birth were available. Secondly, we used questionnaire for the diagnosis of wheezing rather than utilizing tests for bronchial hyperresponsiveness.

Our field workers used Bangla translated of wheezing as 'chest wheezing sound' which was more specific to asthma and to express more severe symptoms. We believe our prevalence rates of wheezing were not overestimated compared to previous studies in Bangladesh.

We observed that the monthly income of the family having wheezing children was lower than the family without wheezing. These factors may cause poor nutrition and predispose for pneumonia which contribute to the subsequent development of wheezing. The results are in agreement with other studies done in Bangladesh.[7] These suggest that there may be other contributing factors which are linked to lower socio-economic environment, in addition to histories of pneumonia identified in the present study, indicating the need for additional studies within the population.

The prevalence of asthma varied among different parts of the world. Studies have shown an increasing trend in developed countries like United Kingdom, New Zealand, United States and Australia.[5,32] Lower prevalence rates of childhood asthma have been reported from the regional countries *e.g.*, India (7%) and Pakistan (8%) .[5] The variations among courtiers should be cautiously interpreted in the context of ecological and methodological differences. Our findings on risk factors for childhood asthma are consistent with study findings from developing countries [33] and developed countries .[34] Our results suggest that wheezing is a significant cause of morbidity among children in rural Bangladesh. Greater efforts are needed to prevent pneumonia among children during their infancy to reduce the chances of subsequent development of wheezing.

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