Annals of Tropical Paediatrics (2000), 20, 95–100

Asthma prevalence in schoolchildren in a city in north-east Brazil

MURILO C. A. DE BRITTO, PATRICIA G. M. BEZERRA, OTELO S. FERREIRA, ISABEL C. V. MARANHAO & GETULIO A. TRIGUEIRO

Department of Paediatric Respiratory Diseases, Instituto Materno Infantil de Pernambuco, Recife, Brazil

(Accepted November 1999)

Summary Asthma is a disease of increasing prevalence all over the world. The objectives of this study were to describe the prevalence of asthma and aspects of its morbidity in schoolchildren in Recife, and to evaluate the relationship between maternal schooling and asthma prevalence during 1994–1995. This is part of an international, multicentre research project, the International Study of Asthma and Allergies in Childhood (ISAAC). In a cross-sectional design, a probabilistic sample of 1410 children of 6 and 7 years of age and 3086 teenagers of 13 and 14 years were studied by questionnaire. The yearly prevalences of asthma symptoms in these two groups were 27.2% (CI 95%: 24.9–29.5%) and 18.1% (CI 95%: 16.4–19.8%), respectively; the cumulative prevalences of diagnosed asthma were 20.4% (CI 95%: 17.8–23.0%) and 19.7% (CI 95%: 19.4–22.2%), respectively, and the prevalences of asthma according to severity were: mild—68.9% and 81.3%, moderate—24.2% and 13.5%, severe—6.80% and 5.3%. During the previous year, the frequencies of crises with sleeping disorder were 23.2% and 13.0% and of disorder that limited speech 9.6% and 4.8%, respectively. There was a significant relationship between maternal education and cumulative prevalence of symptoms in both groups. It is concluded that asthma is a common disease which causes much morbidity in schoolchildren in Recife. The results suggest a relationship between low maternal education and a greater prevalence of asthma.

Introduction

Despite progress in understanding asthma, the definition remains inaccurate.[1,2] This results in variable diagnostic criteria and incorrect estimates of prevalence, and makes comparison between populations difficult. Both clinical and laboratory criteria can be imprecise. Toelle *et al.* proposed that symptoms alone are not reliable and bronchoprovocation tests are required.[3] In their study, 23.8% of children had symptoms of wheezing without bronchial hyper-reactivity. Nevertheless, most researchers agree that questionnaire assessment is a valid way to collect data on asthma prevalence and severity and that it is easy and cheap to perform.[4–7]

According to Fortes, there is great variation in asthma prevalence, from 0.06% in Canadian Eskimos to 32% in Tristan da Cunha islanders.[8] More recent studies reported year prevalences in schoolchildren to be between 3.1% and 26.5%.[9,10]

The interaction between asthma and poverty is not well understood. In a review published 20 years ago, Kuzemko reported conflicting results.[11] Recent investigations

Reprint requests to: Dr Murilo C. A. de Britto, Instituto Materno Infantil de Pernambuco, Rua dos Coelhos 300, Boa Vista, Recife, Brazil 50050-550. Fax: +55 81 222 6591; e-mail: murilobr@cashnet.com.br

ISSN 0272-4936 print/ISSN 1465-328/online/00/020095-06
Carfax Publishing

have implicated poverty as a significant risk factor.[12–15] Theoretically, poor children and adolescents are more likely to exhibit asthma caused by environmental factors and to have less access to health care.

The determination of socio-economic status is complex and multi-factorial. Maternal schooling has been used as an indicator of poverty in a number of Brazilian studies.[16–18]

Prevalence studies are useful in efficient health planning and can help reduce underdiagnosis and undertreatment. ISAAC is a multicentre, international study whose objectives are to describe the prevalence of asthma and other allergies in children from different regions and countries and to provide a basis for comparison between surveys.[19,20] Apart from other Brazilian centres participating in the project, this is probably the first population study of asthma prevalence in children and teenagers in north-east Brazil. The aim was to describe the prevalence and severity of asthma in Recife schoolchildren and how it relates to maternal education.

Material and methods

Recife is a city in north-east Brazil. The medium temperature is 25.3°C and air humidity varies between 72 and 86%.[21] In 1991 there were 1,296,996 residents in the city, 48% of whom were classified as poor. The infant mortality rate was 43.5/1000 and child (1–5 years) mortality 1.8/1000. The main causes of death were perinatal problems and infectious and nutritional diseases.[22] The school drop-out rate was 20.5% and failure rate 23.5%. Illiteracy was 11.3% between 15 and 39 years and 30.6% in those aged 40 years or over.[23]

The data were from ISAAC's database, gathered by questionnaire in two stages (October and November 1994, and July and August 1995), the latter to satisfy the sample size requirements for the ISAAC study.

The data on schools were collected by the education office of Recife. The target schools were randomly selected according to the number of students of the chosen ages, maintaining the ratio of public to private schools in the city (1.86:1). The questionnaires were given only to pupils aged 6 and 7 and 13 and 14 years. The sample size required for each age group was 1935, less than the 3087 collected from teenagers and more than the 1410 from 6 and 7-year-olds.

Definition of variables

- Type of school: public (state or city government, or community-sponsored, free) and private.
- Maternal education was classified as: 1, no schooling; 2, unfinished elementary education; 3, completed elementary education; 4, unfinished secondary education; 5, completed secondary education; 6, undergraduate education (completed or in progress). In Brazil, elementary education is 8 school years and secondary education is 3. This was the only variable added to the ISAAC questionnaire.
- Other variables: according to the ISAAC project.[10,19]

One of the two ISAAC questionnaires was designed to apply to children (to be answered by parents) and the other to teenagers (to answer themselves); both were translated into Portuguese as accurately as possible.

All statistical data were calculated using Epi-Info 6.0. The statistical tests used were Pearson's association χ^2 and χ^2 for trend. The significance level was 5%.

Results

Questionnaires were returned by 100% of the 6–7-years group and 97.6% of the older group. The latter corresponded to 96.3% of the public and 100% of the private schools.

A total of 556 6-year-old and 854 7-year-old children were studied. Mean (median) age was 6.6 (7) years. There were 653 (46.3%) boys and 757 (53.7%) girls. Of the teenagers, 1656 were 13 and 1431 14 years old. The mean (median) age was 13.5 (13) years. There were 1392 (45.1%) boys and 1694 (54.9%) girls.

Details of maternal education are shown in

TABLE I. Level of education of mothers of schoolchildren in Recife, 1995

Mothers' level of education	6–7 years No. (%)	13–14 years No. (%)
None	90 (7.4)	200 (7.2)
Elementary education not completed	359 (29.3)	704 (25.2)
Elementary education completed	113 (9.2)	352 (12.6)
Secondary education not completed	129 (10.5)	162 (5.8)
Secondary education completed	243 (19.8)	560 (20.0)
University education	291 (23.8)	817 (29.2)
Total no. of questions answered	1225 (100)	2795 (100)

Source: ISAAC project.

TABLE II. Dry night cough, without colds or respiratory infection and wheezing caused by exercise in the previous 12 months in schoolchildren in Recife, 1995

	Dry night cough		Wheezing with exercise	
	6–7 years No. (%)	13–14 years No. (%)	6–7 years No. (%)	13–14 years No. (%)
Never had symptoms	900 (63.8)	2180 (70.7)	1186 (84.1)	2522 (81.7)
Had symptoms	488 (34.6)	884 (28.6)	183 (13.0)	522 (16.9)
95% confidence interval	32.1–37.1	26.5–30.7	11.2–14.8	15.2–18.6
Not answered/incorrectly answered	22 (1.6)	22 (0.7)	41 (2.9)	42 (1.4)
Total	1410 (100)	3086 (100)	1410 (100)	3086 (100)

Source: ISAAC project.

Table I. In the younger age group, 185 (13.1%) did not answer the question and in the older group 292 (9.5%).

Reports of prevalence of symptoms, diagnosed asthma, severity of attacks and asthma variants are detailed in Fig. 1 and Tables II–IV.

In both groups, a greater proportion of asthma was diagnosed in boys than in girls ($\chi^2 = 6.45$ and 10.33, respectively, and $p = 0.001$). The cumulative and annual prevalences of asthma symptoms were higher in teenage boys ($\chi^2 = 8.99$ and 5.76, $p = 0.003$ and 0.016, respectively).

There was an association between night cough and diagnosed asthma in the 13–14-years group ($\chi^2 = 57.27$, $p < 0.001$), and there were associations between diagnosed asthma and annual and cumulative prevalences of asthma symptoms in both groups ($p < 0.001$).

Level of education of teenagers' mothers was inversely associated with diagnosed asthma (χ^2 for trend: 57.27; $p < 0.001$) and was inversely associated with cumulative and annual asthma symptoms in 6–7-year-old children (χ^2 for trend: 7.89 and 5.65; $p = 0{,}005$ and 0.017, respectively) and in the 13–14-year-olds (χ^2 for trend: 21.99 and 18.89; $p < 0.001$ for both). In the younger age group, maternal education and number of episodes per year were significantly associated ($\chi^2 = 29.73$, $p < 0.001$).

TABLE III. Frequency of wheezing attacks in the previous year in schoolchildren in Recife, 1995

Frequency of attacks	6–7 years No. (%)	13–14 years No. (%)
1–3	264 (68.9)	494 (81.2)
4–12	93 (24.3)	82 (13.5)
>12	26 (6.8)	32 (5.3)
Total	383 (100)	608 (100)

Source: ISAAC project.

TABLE IV. Frequency of asthma attacks with sleep and with speech disorders in the previous year in schoolchildren in Recife, 1995

	Sleep disorder		Speech disorder	
	6–7 years No. (%)	13–14 years No. (%)	6–7 years No. (%)	13–14 years No. (%)
Never had attacks like that	1048 (74.3)	2666 (86.4)	1242 (88.1)	2928 (94.9)
Had had attacks	327 (23.2)	401 (13.0)	136 (9.6)	149 (4.8)
Incorrect answer	35 (2.5)	19 (0.6)	32 (2.3)	9 (0.3)
Total	1410 (100)	3086 (100)	1410 (100)	3086 (100)

Source: ISAAC project.

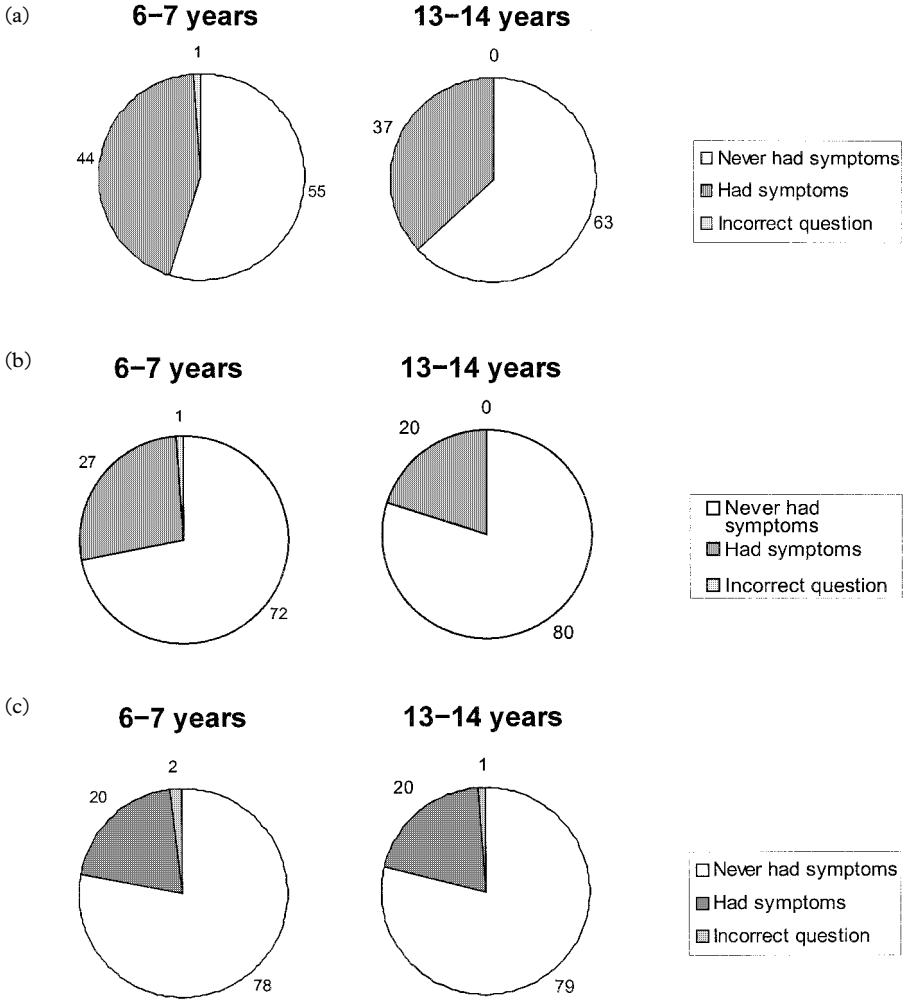

FIG. 1. Prevalences of symptoms and diagnosed asthma in schoolchildren. (a) Cumulative prevalences (%) of asthma symptoms in schoolchildren. (b) Year prevalence (%) of asthma symptoms in schoolchildren by age group. (c) Cumulative prevalences (%) of diagnosed asthma in schoolchildren.

Comparison between the age groups showed that cumulative and annual prevalences of asthma symptoms were significantly greater in the 6–7-years group ($p < 0.001$). Diagnosed asthma showed no difference between age groups.

Analysing data obtained from both periods of questionnaire application, cumulative and annual prevalences of asthma symptoms showed differences, with greater proportions of symptoms in the second phase in the teenage group ($\chi^2 = 8.01$, $p = 0.005$). There were significant differences in level of education in adolescents' mothers (χ^2 for trend, 5.44; $p < 0.020$) with the worst scores in the first phase. There were no significant differences with respect to age and gender.

Discussion

This study used internationally validated questionnaires. Regional validation was not done. Some terms used, such as 'respiratory infection', were imprecise. The low level of maternal education and the high proportion of unanswered questions could have produced some bias. In addition, a video questionnaire was not used because of the cost, although it would have been a useful resource.[7]

The data presented in this study are similar to those reported by Solé in cities in the north-east (Salvador) and south (Porto Alegre) of this country.[24] Compared with results from other countries, Recife has a high prevalence of asthma symptoms and diagnosed asthma, severe forms and variants.[9,10,25–31] The higher prevalence of cumulative symptoms than of diagnosed asthma must in part be attributable to underdiagnosis of asthma.

The higher frequency of less educated mothers in the first phase of the survey remains unexplained, but may be due to school drop-outs. The reason for the high prevalence of asthma symptoms in both cumulative and annual prevalences in the second phase of questionnaires was also not properly understood. The short period between the first and second step makes cohort effect unlikely. In other words, it was unlikely that these rates had been increased by environmental or individual changes occurring during this period.

Socio-economic status can be evaluated by many indicators. Maternal education is a useful proxy indicator.[16–18] The results showed an inverse association between maternal education and a higher prevalence of diagnosed asthma, although not with severity nor frequency of attacks. In an ISAAC survey in Singapore, multivariate analysis showed that a higher prevalence of wheezing was associated with higher socio-economic status. It is reasonable to conclude that in north-east Brazil poverty might be a risk factor. Subsequent studies with multivariate analyses are needed to clarify this question.

These results cannot be extrapolated to the entire population of the same age groups in Recife because a large proportion of poor children exposed to unfavourable environmental conditions were not attending school.

Recife has significant air pollution.[21] Furthermore, its high temperature and humidity are conducive to the growth of dermatophagoids and fungis, major triggers of symptoms in Brazil.[32] Less access to effective health centres could also contribute to these findings.

It can be concluded that asthma is highly prevalent in Recife, as are severe attacks. Health authorities and the medical community should be aware of this problem so that appropriate action may be taken.

Acknowledgments

This work was supported by the Instituto Materno Infantil de Pernambuco, The Paediatric Society of Pernambuco and Escola Modelo. We wish to thank Maria Cristina Raposo, José Edmilson Batista and Ricardo Ximenes for help in developing the sampling, and Ester Calland for collecting the data from schools.

References

1 Warner JO, Niejens HJ, Landau LI, *et al.* Asthma: a follow-up statement from an international paedi-

atric asthma consensus group. Arch Dis Child 1992; 67:240–9.
2 National Heart, Lung and Blood Institute, World-Health Organization. Global Strategy for Asthma Management and Prevention. Bethesda, MD: US Department of Health and Human Services, 1995.
3 Toelle BG, Peat JK, Salome CM, Mellis CM, Woolcock AJ. Towards a definition of asthma epidemiology. Am Rev Respir Dis 1992; 145:633–7.
4 Usherwood TP, Scrimgeour A, Barber JH. Questionnaire to measure perceived symptoms and disability in asthma. Arch Dis Child 1990; 65:779–81.
5 Anderson HR, Buttland BK, Strachan DP. Trends in prevalence and severity of childhood asthma. Br Med J 1994; 308:1600–4.
6 Shaw RA, Crane J, Pearce N, *et al.* Comparison of a video questionnaire with the IUATLD written questionnaire for measuring asthma prevalence. Clin Exp Allergy 1992; 22:561–8.
7 Shaw R, Woodman K, Ayson M, *et al.* Measuring the prevalence of bronchial hyper-responsiveness in children. Int J Epidemiol 1995; 24:597–602.
8 Fortes PAC. Contribuição para o estudo da asma grave na criança. Tese, Universidade de São Paulo, São Paulo, 1986.
9 Robertson CF, Bishop J, Sennhauser FH, Mallol J. International comparison of asthma prevalence in children: Australia, Switzerland, Chile. Pediatr Pulmonol 1993; 16:219–26.
10 Strachan DP, Anderson HR, Limb ES, O'Neill A, Wells N. A national survey of asthma prevalence, severity and treatment in Great Britain. Arch Dis Child 1994; 70:174–8.
11 Kuzemko JA. Natural history of childhood asthma. J Pediatr 1980; 97:886–92.
12 Crain EF, Weiss KB, Bijur PE, Hersh M, Westbrook L, Stein REK. An estimate of the prevalence of asthma and wheezing among inner-city children. Pediatrics 1994; 94:356–62.
13 Ernst P, Dimissie K, Joseph, Locher U, Becklake MR. Socioeconomic status and indicators of asthma in children. Am J Respir Crit Care Med 1995; 152:570–5.
14 Halfon N, Newacheck PW. Childhood asthma and poverty: differential impacts and utilisation of health services. Pediatrics 1993; 91:56–61.
15 Victora CG, Barros FC, Vaughan JP. Epidemiologia da desigualdade. São Paulo, Hucitec/ABRASCO, 1989.
16 Sousa FJP. Pobreza, desnutrição e mortalidade infantil. Condicionantes socioeconômicos. Fortaleza, IPLANCE/UNICEF 1992; mimeo, 129pp.
17 Benicio MHA, Latorre MRDO, Rosa TE, Nazario CL, Monteiro CA. Modelos estatísticos de predição da prevalência da desnutrição infantil: desenvolvimento e aplicação para o conjunto dos municípios brasileiros. Technical report, 1995; 128pp.
18 Monteiro CA. A origem social. In: Monteiro CA, ed. Saúde e Nutrição das Crianças de São Paulo. Hucitec, 1988; 21–32.
19 Asher MI, Keil U, Anderson HR, *et al.* International Study of Asthma and Allergies in Childhood (ISAAC): rationale and methods. Eur Respir J 1995; 8:483–91.
20 Keil U, Weiland S. International asthma and allergy study. Lancet 1992; 340:46.
21 Companhia Pernambucana de Controle da Poluição Ambiental e de Administração de Recursos Hídricos (CPRH). Estimativa de emissões de poluentes atmosféricos provenientes de fontes estacionárias. Área de estudo: região metropolitana do Recife. Recife: CPRH, 1994.
22 Prefeitura da Cidade do Recife. Secretaria de planejameneto urbano e ambiental. Situa-ção econômica e social do Recife. Recife: Technical report, 1993.
23 Pefil estatístico de crianças e mães no Brasil. Sistema de acompanhamento da situação socioeconomica de crianças e adolescentes. Vol. I: Brasil, grandes regiões e regiões metropolitanas. Rio de Janeiro: UNICEF, FCBIA, 1987; 1:206–22.
24 Solé D. Epidemiology of Asthma—Theme: Brazil. Round table. VI Brazilian Congress of Allergy and Immunology in Paediatrics. Recife, Brazil, 26th March 1997.
25 Barry DM, Burr ML, Limb ES. Prevalence of asthma among 12-year-old children in New Zealand and South Wales: a comparative survey. Thorax 1991; 46:405–9.
26 Zhong NS, Chen RC, O-yang M, Wu JY, Fu XJX, Shi LJ. Bronchial hyperresponsiveness in young students of southern China: relation to respiratory symptoms, diagnosed asthma, and risk factors. Thorax 1990; 45:860–5.
27 Pararajasingam CD, Sittampalam L, Damani P, Pattermore PK, Holgate ST. Comparison of the prevalence of asthma among Asian and European children in Southampton. Thorax 1992; 47:529–32.
28 Goh DYT, Chew FT, Quek SC, Lee BW. Prevalence and severity of asthma, rhinitis and eczema in Singapore schoolchildren. Arch Dis Child 1996; 74:131–5.
29 Nichols DJ, Longsworth FG. Prevalence of exercise-induced asthma in schoolchildren in Kingston, St Andrew and St Catherine, Jamaica. West Indian Med J 1995; 44:16–19.
30 Robertson CF, Heycock E, Bishop J, Nolan T, Olinsky A, Phelan PD. Prevalence of asthma in Melbourne schoolchildren: changes over 26 years. Br Med J 1991; 302:1116–19.
31 Pearce N, Weiland S, Keil U, *et al.* Self-reported prevalence of asthma symptoms in children in Australia, England, Germany and New Zealand: an international comparison using the ISAAC protocol. Eur Respir J 1993; 6:1455–61.
32 Rizzo MCFV, Solé D, Rizzo A, *et al.* Etiologia da doença atópica em crianças brasileiras—estudo multicêntrico. J Pediatr 1995; 71:31–5.