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Asthma and allergies in Jamaican children aged 2–17 years: a cross-sectional prevalence survey

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ABSTRACT

Objective: To determine the prevalence and severity of asthma and allergies as well as risk factors for asthma among Jamaican children aged 2–17 years.

Design: A cross-sectional, community-based prevalence survey using the International Study of Asthma and Allergies in Childhood questionnaire. The authors selected a representative sample of 2017 children using stratified, multistage cluster sampling design using enumeration districts as primary sampling units.

Setting: Jamaica, a Caribbean island with a total population of approximately 2.6 million, geographically divided into 14 parishes.

Participants: Children aged 2–17 years, who were resident in private households. Institutionalised children such as those in boarding schools and hospitals were excluded from the survey.

Primary and secondary outcome measures: The prevalence and severity of asthma and allergy symptoms, doctor-diagnosed asthma and risk factors for asthma.

Results: Almost a fifth (19.6%) of Jamaican children aged 2–17 years had current wheeze, while 16.7% had self-reported doctor-diagnosed asthma. Both were more common among males than among females. The prevalence of rhinitis, hay fever and eczema among children was 24.5%, 25% and 17.3%, respectively. Current wheeze was more common among children with rhinitis in the last 12 months (44.3% vs 12.6%, $p<0.001$), hay fever (36.8% vs 13.8%, $p<0.001$) and eczema (34.1% vs 16.4%, $p<0.001$). Independent risk factors for current wheeze (ORs, 95% CI) were chest infections in the first year of life 4.83 (3.00 to 7.77), parental asthma 4.19 (2.8 to 6.08), rhinitis in the last 12 months 6.92 (5.16 to 9.29), hay fever 4.82 (3.62 to 6.41), moulds in the home 2.25 (1.16 to 4.45), cat in the home 2.44 (1.66 to 3.58) and dog in the home 1.81 (1.18 to 2.78).

Conclusions: The prevalence of asthma and allergies in Jamaican children is high. Significant risk factors for asthma include chest infections in the first year of life, a history of asthma in the family, allergies, moulds and pets in the home.

ARTICLE SUMMARY

Article focus

- The prevalence of asthma and allergies in both developed and developing countries is continuing to rise.
- In some Caribbean countries, asthma is a public health problem associated with high economic costs.
- This study determined the prevalence of asthma, allergy symptoms and associated risk factors.

Key messages

- We demonstrated that the prevalence of asthma and allergy symptoms among Jamaican children aged 2–17 years is high.
- Both the prevalence and severity of asthma symptoms are comparable to that reported among children in high-income countries.
- Current wheeze and doctor-diagnosed asthma were more common in males and in children with allergies.
- A history of asthma in the family, chest infections in the first year of life, allergies, exposure to moulds and pets in the home were associated with significant risk for asthma.
- Identifying children at high risk for asthma and controlling modifiable risk factors is important in reducing the prevalence and morbidity related to asthma.

Strengths and limitations of this study

- This is the first national study on asthma and allergies in Jamaica using a nationally representative sample of children with a response rate of 80%.
- We used a modified ISAAC protocol in which sampling was done by household rather than by school. Using a population-based sampling strategy; we sampled one child and one adult per household. This approach enabled us to obtain national prevalence estimates for both adults and children in one survey at a reduced cost.
- Limitations of this study include the fact that the prevalence of asthma and allergies was based solely on self-reports, no objective measures were done. Also in younger children, caregivers responded to questionnaires.

INTRODUCTION

Epidemiological studies examining asthma prevalence trends among children in both developed and developing countries suggest that the prevalence of asthma and other allergic diseases is continuing to rise.[1] The International Study of Asthma and Allergies in Childhood phase 3 (ISAAC) indicated an increase in asthma symptoms in Latin America, Africa and parts of Asia over a 5–10-year period.[1] While the prevalence of asthma and other allergic disorders in most Caribbean countries is not known, in ISAAC phase 3, the prevalence of current wheeze among Barbadian children aged 6–7 years and 13–14 years was 19.2% and 20.9%, respectively.[1] In another study, the prevalence of current wheeze in the 11–19-year age group was 13.1% in Trinidad and 13.4% in Tobago.[2] While causes of the observed increase in asthma prevalence are not clearly understood, current evidence suggests that gene–environment interactions underlie most of the increase and worldwide variations.[3] Known risk factors for asthma include genetic, lifestyle, environmental factors and demographic variables.[3]

In Jamaica, current data on the prevalence of asthma, allergies and risk factors associated with these diseases are lacking. The most recent asthma prevalence estimates were from a small clinical cohort of children aged 5–10 years using a modified ISAAC questionnaire, which reported 48% asthma prevalence among children with sickle cell disease and 22% among ethnic-matched controls.[4] A larger school-based study reported an asthma prevalence of 21% among high school children. However, this study was conducted in 1981 using a non-standardised questionnaire.[5] The objectives of this national survey were (1) to determine the prevalence and severity of asthma and allergy symptoms among Jamaican children aged 2–17 years and (2) to determine risk factors for asthma in children. Current asthma and allergy prevalence data are critical for healthcare planning. Identifying modifiable risk factors for asthma may inform strategies for primary prevention and management.

METHODS

Study design

A nation wide, cross-sectional, community-based prevalence survey. Methods used in the survey have been described in detail elsewhere.[6]

Setting

Jamaica is a Caribbean island with a total population of approximately 2.6 million. The country is geographically divided into 14 parishes consisting of 5235 enumeration districts (EDs) stratified into 2542 urban and 2693 rural EDs. The survey was conducted in all 14 parishes during the period January to March 2007.

Participants

Two thousand and seventeen children aged 2–17 years participated in the survey. Children younger than 2 years were excluded from the study since conditions such as bronchiolitis and other causes of wheezing and coughing that cannot be differentiated from asthma symptoms are common in this age group. Children were eligible to participate in the study only if they were residents of selected households. Children in institutions such as boarding schools and hospitals were excluded from the study.

Stratified, multistage cluster sampling design using EDs as primary sampling units was done similar to other national surveys. A detailed description of the sampling design is presented elsewhere.[6] Briefly, in stage 1, a random sample of EDs was selected proportional to parish size and independently from both urban and rural EDs. Stage 2 involved the selection of households using systematic probability sampling. A total of 3719 households were selected. The Kish selection table[7] was then used to select one eligible child per household in stage 3 yielding a sample size of 2017.

Data collection procedures

The ISAAC phase 2 questionnaire was interviewer administered to caregivers of children younger than 12 years and to children aged 13 years and older in the presence of their caregivers. The questionnaire included items on the presence and severity of asthma and allergy symptoms, doctor-diagnosed asthma, risk factors for asthma, past and present environmental exposures.[8] Demographic data collected for children include age, sex and race as observed by the interviewer. Questions related to risk factors for asthma were answered by the caregiver. The question asking "has your child ever had asthma" was modified to "has your child ever had asthma or even a touch of asthma?" since the latter term is used in Jamaica to describe cases of mild-to-moderate asthma.[4] Another question "was asthma diagnosed by the doctor?" was added to the questionnaire. Questionnaires were administered in English.

Data analysis

Data analysis accounted for sampling design, produced weighted prevalence estimates for asthma and allergy symptoms and doctor-diagnosed asthma with SE estimates adjusted for the multistage sampling design used in the study. Prevalence estimates were obtained for each of the four age categories (2–4, 5–9, 10–14 and 15–17 years). Separate estimates were obtained for the 6–7-year and 13–14-year age groups to facilitate comparison of results from this study with results from studies that used the ISAAC questionnaire in the 6–7-year and 13–14-year age groups. Sex-specific estimates of prevalence were also obtained within the entire age range (2–17 years) studied, the 6–7-year and 13–14-year age groups and area of residence to determine urban/rural differences in asthma prevalence. In Jamaica, a place is classified as an urban area if it has a population of 2000 or more people and provides a number of amenities and utilities which indicate modern living.[9] The severity of asthma symptoms

in the last 12 months was assessed using responses to questions on the number of attacks of wheezing in the last 12 months and wheezing resulting in sleep disturbance or limiting speech to one or two words.

χ^2 Tests corrected for variability due to multistage sampling design (Rao-Scott correction yielding F-statistic) and logistic regression were used to determine the nature of the association between risk factors, asthma and allergy symptoms and demographic variables. Stata V.10.0 was used to carry out data analysis.[10]

Logistic regression models produced ORs indicating associations between 'current wheeze' (wheezing in the last 12 months) and risk factors adjusted for confounders such as age, sex and area of residence. Risk factors included in models were those significantly associated with current wheeze in bivariate analyses.

RESULTS

A sample of 2017 children aged 2–17 years consisting of 1019 males (50.6% of the population of 2–17-year-olds) and 998 females (49.4% of the population of 2-17-year-olds) were recruited for the study yielding a response rate of 80%. Most of the children (64.5%) were in the 5–14-year age group and predominantly black (94.0%). Just over half of the sample (53.6%) was recruited from rural areas. Demographic characteristics of the sample are shown in table 1.

The prevalence of asthma symptoms by sex and area of residence

Prevalence estimates and 95% CIs for prevalence and severity of asthma and allergy symptoms by sex are shown in table 2. The overall prevalence of current wheeze among children aged 2–17 years was 19.6% (17.60% to 21.67%). Current wheeze and doctor-diagnosed asthma were more common among males than among females.

There were no significant urban/rural differences in the prevalence of current wheeze (18.5% urban, 20.5% rural, p=0.31) and doctor-diagnosed asthma (18.3% urban, 15.4% rural, p=0.15).

Table 1 Demographic characteristics of the sample

Variables	Unweighted sample, n (%)	Weighted sample (%)
Age in years		
2–4	370 (18.3)	18.4
5–9	666 (33.0)	33.3
10–14	639 (31.7)	31.2
15–17	342 (16.9)	17.1
Sex		
Male	1019 (50.5)	50.6
Female	998 (49.5)	49.4
Observed race		
African–American	1893 (94.5)	94.0
Mixed	102 (5.1)	5.5
Indian	7 (0.4)	0.5
Area of residence		
Urban	912 (45.2)	46.4
Rural	1105 (54.8)	53.6

Age-related differences in the prevalence and severity of asthma symptoms

The prevalence and severity of asthma symptoms by age is shown in table 3. Children aged 2–4 years had a significantly higher prevalence of current wheeze, 'wheeze ever' and exercise-induced wheeze compared with older age groups and were more likely than older children to have severe asthma symptoms.

The prevalence and severity of allergy symptoms by age, sex and area of residence

The prevalence and severity of allergy symptoms in children aged 2–17 years is also shown in tables 2 and 3. There were no significant sex-specific differences in the prevalence of allergy symptoms. However, significantly more females than males reported having 'itchy rash ever' and flexural rash.

There were significant age-related differences in the prevalence of allergy symptoms. The prevalence of rhinitis increased with increasing age (table 3). The 15–17-year age group had the highest prevalence of 'rhinitis ever' (38.7%), rhinitis in the last 12 months (32.6%) and 'hay fever ever' (40.6%) compared with younger age groups.

The only difference found in allergy symptoms based on area of residence was the higher prevalence of 'eczema ever' among children in urban compared with those in rural areas (19.9% urban, 15.1% rural, p=0.02).

The prevalence of asthma and allergy symptoms in the 6–7-year and 13–14-year age groups

In the 6–7-year age group, the prevalence of current wheeze was 22.4% and doctor-diagnosed asthma was 20.2%. There were no statistically significant gender differences in the prevalence and severity of asthma symptoms (table 4). Among the 13–14-year-olds, the prevalence of current wheeze was 18.5% and doctor-diagnosed asthma was 19.2%. There were no statistically significant differences between males and females in the prevalence of current wheeze and doctor-diagnosed asthma. However, in this age group, more males (13%) than females (3.9%, p=0.02) had 4 to 12 wheezing attacks in the last 12 months, suggesting severe asthma.

The prevalence of asthma symptoms among children with allergies

The prevalence of asthma symptoms was significantly higher in children who had allergies (table 5). More than three times as many children who had "rhinitis in the last 3 months" had current wheeze (44.3% vs 14.1%, p<0.001) and nocturnal cough (43.8% vs 9.7%, p<0.001). Doctor-diagnosed asthma was also twice as common among children who had rhinitis in the last 12 months (32.9% vs 12.0%, p<0.001), hay fever (26.6% vs 13.3%, p<0.001) and eczema (29.4% vs 14.0%, p<0.001) compared with children without allergies.

Table 2 Weighted prevalence estimates (%) and 95% CI for asthma and allergy symptoms by sex

	Male (n=1019)	Female (n=998)	Total (n=2017)	95% CI	p Value
Asthma symptoms					
Ever had wheezing	21.8	21.2	21.5	19.4 to 23.8	0.78
Wheezing in the last 12 months	20.6	18.5	19.6	17.6 to 21.7	0.03
Number of attacks of wheezing in the last 12 months					
1–3 times	13.2	12.3	12.8	11.2 to 14.6	0.70
4–12 times	5.9	5.1	5.5	4.4 to 6.8	
>12 times	1.4	1.1	1.3	0.9 to 1.9	
Sleep disturbance due to wheezing in the last 12 months					
<Once/week	8.9	5.5	7.2	5.9 to 8.8	0.04
>Once/week	5.0	6.3	5.6	4.5 to 7.0	
Wheezing limited speech to 1 or 2 words	6.7	4.7	5.7	4.7 to 6.9	0.19
Wheezing occurring during or after exercise	10.2	8.7	9.4	8.0 to 11.0	0.47
Asthma ever	19.5	17.0	18.2	16.2 to 20.4	0.16
Asthma diagnosed by a doctor	17.2	16.2	16.7	14.8 to 18.8	0.01
Dry night cough at night unrelated to cold/chest infection	16.5	18.4	17.4	15.3 to 19.8	0.33
Rhinitis					
Rhinitis ever	23.5	25.6	24.5	22.3 to 27.0	0.34
Rhinitis in the last 12 months	19.3	21.3	20.3	18.1 to 22.6	0.59
Burning, itchy, watery eyes	13.3	14.3	13.8	12.0 to 15.8	0.59
Rhinitis affected daily activities					
Not at all	9.2	10.1	9.6	8.1 to 11.4	0.85
A little	6.8	7.8	7.3	6.1 to 8.7	
Moderate	1.5	1.7	1.6	1.1 to 2.5	
A lot	1.3	1.5	1.4	1.0 to 2.1	
Ever had hay fever	24.3	25.7	25.0	22.5 to 27.7	0.57
Eczema					
Itchy rash ever	14.2	18.4	16.3	14.4 to 18.3	0.01
Flexural rash	10.5	14.0	12.2	10.5 to 14.0	0.03
Child awakened by itchy rash in the last 12 months					
Not at all	89.3	85.7	87.5	85.6 to 89.1	0.19
<Once/week	2.9	3.3	3.1	2.4 to 4.1	
>Once/week	2.1	2.7	2.4	1.8 to 3.3	
Rash cleared completely	8.3	11.9	10.0	8.7 to 11.6	0.05
Eczema ever	16.4	18.3	17.3	15.4 to 19.5	0.33

Risk factors for asthma among Jamaican children

Unadjusted ORs and 95% CI associated with risk factors for current wheeze are shown in table 6. In bivariate analysis, significant risk factors for current wheeze were chest infections in the first year of life, maternal and paternal asthma, allergies, moulds and the presence of pets in the home currently and in the first year of life. Table 7 shows ORs resulting from multiple regression analysis adjusted for age, sex and area of residence in which chest infections in the first year of life, parental asthma, allergies, the presence of pets and moulds in the home retained statistical significance.

DISCUSSION

In this prevalence survey, almost a fifth (19.6%) of Jamaican children aged 2–17 years had current wheeze, while 16.7% had self-reported doctor-diagnosed asthma. Both were more common among males than among females. Almost 6% (5.5%) of children had severe asthma. The prevalence of rhinitis, hay fever and eczema among children was 24.5%, 25% and 17.3%, respectively. Current wheeze was more common among children with rhinitis in the last 12 months, hay fever and eczema. Significant risk factors for asthma were chest infections in the first year of life, parental asthma, rhinitis in the last 12 months, hay fever, moulds as well as cats and dogs in the home.

To our knowledge, this is the first population-based study of asthma and allergy symptoms among Jamaican children. We have shown that the prevalence of asthma is high and comparable to the high prevalence ranging between 15% and 20% reported in high-income countries.[1] Within the Caribbean, the prevalence of asthma in Jamaican children is similar to that observed among Barbadian children aged 6–7 and 13–14 years but differs from the lower prevalence observed in the 11–19-years-olds in Trinidad and Tobago.[1 2] While the differences in prevalence may in part be due to differences in the age studied, variations in asthma prevalence from country to country and within countries have been reported.[1]

Table 3 Weighted prevalence estimates (%) and severity of asthma and allergy symptoms by age

	Age in years					
	2–4 (n=370)	5–9 (n=666)	10–14 (n=639)	15–17 (n=342)	Total (n=2017)	p Value
Asthma symptoms						
Wheezing ever	29.2	22.0	18.7	17.2	21.5	0.001
Wheezing in the last 12 months	27.8	20.2	16.6	14.9	19.6	0.002
Number of wheezing attacks in the last 12 months						
1–3 times	18.3	12.8	10.5	10.8	12.8	0.004
4–12 times	8.2	6.0	4.9	2.6	5.5	
>12 times	1.3	1.3	1.2	1.4	1.3	
Sleep disturbance due to wheezing in the last 12 months						
≤1 night/week	8.5	8.4	6.6	4.5	7.2	0.002
>1 night/week	9.3	5.9	4.3	3.5	5.6	
Wheezing limited speech to 1 or 2 words	3.9	6.9	5.7	5.4	5.7	0.001
Asthma ever	19.1	20.5	16.8	15.5	18.2	0.29
Asthma diagnosed by a doctor	16.8	19.6	15.7	12.7	16.7	0.05
Wheezing during or after exercise	12.8	9.2	8.6	7.8	9.4	0.002
Dry night cough unrelated to cold/chest infection	22.8	15.4	14.8	20.4	17.4	0.010
Rhinitis						
Rhinitis ever	20.2	19.1	25.2	38.7	24.5	0.001
Rhinitis in the last 12 months	17.6	15.7	19.9	32.6	20.3	0.001
Burning, itchy, watery eyes	11.3	10.8	13.8	22.4	13.8	0.001
Rhinitis affected daily activities						
Not at all	9.5	7.1	9.9	14.3	9.6	<0.001
A little	5.2	5.2	7.9	12.6	7.3	
Moderate	1.9	1.4	0.9	3.2	1.6	
A lot	1.1	1.4	1.0	2.6	1.4	
Ever had hay fever	14.8	19.4	28.5	40.6	25.0	<0.001
Eczema						
Itchy rash ever	24.5	18.7	11.3	11.7	16.3	<0.001
Itchy rash in the last 12 months	18.4	14.5	9.2	9.7	12.8	<0.001
Flexural rash	18.4	14.3	8.4	8.3	12.2	<0.001
Child awakened by itchy rash in the last 12 months						
Not at all	10.3	7.1	5.3	6.5	7.0	0.01
<Once/week	4.7	4.4	1.4	2.1	3.1	
>Once/week	2.9	2.7	2.5	1.1	2.4	
Rash cleared completely	15.2	11.2	7.2	7.3	10.0	0.008
Eczema ever	29.3	19.1	12.8	9.3	17.3	<0.001

The hygiene hypothesis which posits that exposure to infection in early childhood is protective against allergic diseases has been used to explain the low prevalence of asthma in poor countries where standards of hygiene are low resulting in high exposure to infections.[11] However, ISAAC phase 3 and several other studies reported high asthma prevalence in low-income countries in Africa and Latin America.[1 12 13] Given the observed increase in asthma prevalence in poor countries, some authors have questioned the ability of the 'hygiene hypothesis' to explain the current trends in asthma prevalence.[14] Although the aetiology of asthma is still not clearly understood, current evidence suggests complex interactions between multiple genes and environmental factors contributing to asthma susceptibility.[3 15 16]

Several factors may account for the high prevalence of asthma among Jamaican children. First, there seems to be a high genetic predisposition to asthma evidenced by a high proportion of children with a family history of asthma. Nearly half (45.5%) of the children in the sample had a parent with asthma, 50.8% had a father who had asthma and 44.3% had a mother with asthma. Parental history of asthma was associated with four times the risk for asthma. While increased risk of asthma among children with a family history of asthma has been reported in several other studies,[17–22] the proportion of

Table 4 Weighted prevalence estimates (%) of asthma and allergy symptoms in 6–7 and 13–14-year-olds

	6–7 years				13–14 years			
	Male (n=138)	Female (n=130)	Total (n=268)	p Value	Male (n=105)	Female (n=107)	Total (n=212)	p Value
Asthma symptoms								
Ever had wheezing	24.5	25.6	25.1	0.84	20.4	20.4	20.4	0.99
Wheezing in the last 12 months	23.7	21.1	22.4	01.7	18.5	18.4	18.5	0.99
Number of attacks of wheezing in the last 12 months								
1–3 times	10.6	15.4	13.0	0.23	5.5	13.4	9.5	0.02
4–12 times	10.3	4.3	7.3	0.23	13.0	3.9	8.3	
>12 times	2.6	1.3	1.9	0.23	0.0	1.1	0.5	
Sleep disturbed by wheezing in the last 12 months								
<Once/week	11.0	10.2	10.6	0.17	9.8	5.4	7.6	0.24
>Once/week	2.1	6.4	4.2	0.13	5.3	2.8	4.0	0.67
Wheezing limited speech to 1 or 2 words	12.5	6.4	9.4	0.28	8.7	6.0	7.3	0.71
Wheezing occurring during or after exercise	11.3	12.0	11.6	0.76	8.6	6.8	7.7	0.84
Ever had asthma	19.8	21.5	20.7	0.77	24.7	15.4	20.0	0.15
Asthma diagnosed by a doctor	18.8	21.5	20.2	0.39	23.7	14.9	19.2	0.23
Dry cough at night unrelated to cold/chest infection	15.3	20.2	17.8	0.34	21.3	14.5	17.8	0.22
Rhinitis								
Rhinitis ever	22.4	9.5	15.9	0.003	21.6	33.0	27.4	0.12
Rhinitis in the last 12 months	17.9	7.5	12.7	0.01	18.6	26.4	22.6	0.21
Burning, itchy, watery eyes	13.3	6.1	9.7	0.02	14.4	23.6	19.1	0.29
Rhinitis affecting daily activities								
Not at all	10.6	1.8	6.2	0.05	6.3	17.5	12.1	0.12
A little	5.5	3.5	4.5	0.05	11.2	7.0	9.0	
Moderate	0.5	0.8	0.7	0.05	0	0.7	0.3	
A lot	0.9	1.3	1.2	0.05	1.1	0.7	0.9	
Ever had hay fever	25.8	12.7	19.2	0.01	28.3	46.1	37.4	0.02
Eczema								
Itchy rash ever	11.6	22.1	16.9	0.03	10.5	7.8	9.1	0.51
Itchy rash in the last 12 months	6.6	17.3	11.9	0.15	9.5	7.3	8.4	0.59
Flexural rash	6.6	16.8	11.8	0.01	9.5	5.8	7.6	0.30
Child awakened by itchy rash in the last 12 months								
Not at all	2.3	7.9	5.1	0.06	5.6	4.1	4.8	0.41
<Once/week	2.1	5.8	3.9	0.06	0	1.4	0.7	
>Once/week	2.2	2.0	2.1	0.06	3.9	1.8	2.9	
Rash cleared completely	6.6	12.6	9.6	0.02	6.8	6.8	6.8	0.39
Eczema ever	18.1	19.2	18.7	0.8	12.9	6.6	9.7	0.15

children (almost 50%) with a family history of asthma in this study is higher than 12.6% reported in children from rural and 28.1% in children from urban areas in Kenya,[19] 16% in Nigerian children[20] but comparable to 52.8% in a study involving preschool children in Australia,[21] and 56.8% of children involved in a birth cohort evaluating the risk for allergy and asthma in the USA.[22] While genetic predisposition alone is neither enough nor necessary for asthma to occur, it has been suggested that asthma results from environmental exposures of genetically susceptible individuals.[3 17]

Although allergies are acknowledged as a risk factor for asthma, the role of allergy in asthma has not been clarified.[23] In Jamaican children, the prevalence of current wheeze was significantly higher among children who had rhinitis, hay fever and eczema. Rhinitis in the last 12 months was associated with a sevenfold increase in the risk for asthma. This is in contrast to reports suggesting that asthma in developing countries is non-atopic.[24]

Studies in some Caribbean countries suggest high allergic hypersensitivity among individuals with asthma.[25] Comorbid allergic rhinitis was reported in 53.9% of Trinidadian children with severe asthma.[26] In studies where skin reactivity tests were done, 50%–81% of individuals with asthma showed reactivity to at least one antigen, most commonly house dust mites. Researchers

Table 5 Weighted prevalence estimates (%) of asthma symptoms among children with allergies

	Rhinitis ever		Rhinitis in the last 12 months		Hay fever ever		Eczema ever	
Asthma symptoms	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Wheezing ever	44.2	14.1***	48.6	14.1***	40.1	15.3***	37.1	18.1***
Wheezing in the last 12 months	40.9	12.6***	44.3	12.6***	36.8	13.8***	34.1	16.4***
Number of wheezing in the last 12 month								
1–3 times	23.5	9.3***	24.9	9.3***	22.8	9.4***	24.4	10.2***
4–12 times	13.4	2.9***	14.7	2.9***	11.2	3.6***	8.1	4.9***
>12 times	4.0	0.4***	4.7	0.4***	2.8	0.8***	1.5	1.2
Sleep disturbance due to wheezing in the last 12 months								
1 night/week	15.1	4.6***	15.8	4.6***	12.5	5.4***	11.2	6.2***
>1 night/week	13.6	3.0***	15.1	3.0***	12.1	3.5***	12.6	4.1***
Wheezing limits speech to 1 or 2 words	12.3	3.6***	14.4	3.6***	11.5	3.8***	7.2	5.2
Asthma ever	34.2	13.0***	36.6	13.0***	29.7	14.3***	32.8	15.2***
Asthma diagnosed by a doctor	31.1	12.0***	32.9	12.0***	26.6	13.3***	29.4	14.0***
Wheezing during or after exercise	23.1	5.0***	25.9	5.5***	18.3	6.5***	17.7	7.7***
Dry night cough unrelated to cold/chest infection	41.2	9.7***	43.8	9.7***	33.4	12.1***	29.4	14.9***

***p<0.001.

also reported high densities of house dust mite allergens in mattresses and bedroom dust samples throughout the year due to high temperatures and humidity that are normally found in Caribbean countries.[25] In Jamaica, Knight-Madden and colleagues[27] reported skin test reactivity to at least one allergen in 33.8% of children with asthma. They observed frequent sensitivity to *Dermatophagoides farinae*, *Dermatophagoides pteronyssinus* and cockroach allergens among Jamaican children and adults with asthma. Also in this study, the presence of moulds, in the home, was a significant risk factor for current wheeze. This finding is consistent with results of a study in which 82% of patients with allergic respiratory disease in Jamaica showed reactivity to moulds on skin testing.[28] This is attributed to the hot and humid climate in the Caribbean that promotes the growth of moulds.[25] Although studies in some Caribbean countries suggest low sensitivity to cat and dog dander,[24] in this study, the presence of cats and dogs in the home was associated with increased risk for current wheeze. Altogether, these findings suggest a role for allergy in asthma in this population.

It has been suggested that a greater portion of allergy symptoms among children in developing countries are due to non-allergic causes such as environmental tobacco smoke.[28] The prevalence of smoking in this study was 23.3% and (20.2%) of children in this study live with a relative who smokes. In Jamaica, another major source of environmental smoke is open burning of sugarcane fields and other agricultural fields due to slash/burn farming practices, burning garbage and spontaneous combustion of solid waste at dumpsites.[29]

According to the National Environment Planning Agency, in addition to open burning, poor air quality in Jamaica is due to emissions of pollutants from industries, motor vehicles resulting from population growth, a high level of energy use, a growing number of motor vehicles and poor domestic industrial practices.[29] The National Environment Planning Agency 2010 report identifies sulphur dioxide, nitrogen oxides and particulate matter as major pollutants causing major damage to the environment and human health in Jamaica.[29] Although the role of such pollutants in the initiation of asthma has not been ascertained, ambient air pollution is associated with exacerbations of existing asthma and deterioration in lung function.[30] These environmental factors are contributors to the high prevalence of asthma and other respiratory symptoms in susceptible population.[31]

Internationally, higher prevalence of asthma has mainly been reported in urban populations.[19 32 33] However, urban/rural differences in asthma prevalence seem to be decreasing.[34] In this study, there were no significant urban/rural differences in the prevalence of current wheeze (20.5% vs 18.5%, p=0.31) and doctor-diagnosed asthma (915.4% vs 18.3%, p=0.18). Nicolaou and colleagues[34] suggested that increasing asthma prevalence in rural areas could be due to urbanisation and modernisation of rural environments. These authors also suggested that urban/rural differences in the prevalence of asthma reported in some studies could be due to how urban and rural areas are defined in different settings, differences in types of exposures, cultural practices and lifestyle factors, which present a challenge in comparing data from different settings.[34] We hypothesised that the lack of significant urban/rural differences in prevalence of current wheeze in this study may in part be due to how urban and rural areas are defined in Jamaica, modernisation of rural environments and exposure to environmental factors some of which emanate from alumina and cement factories, sugar refineries and other industries which are located in rural areas.[29 35]

Table 6 Unadjusted OR (95% CI) for risk factors associated with current wheeze

	Current wheeze			
Risk factor	**Yes (%)**	**No (%)**	**OR (95% CI)**	**p Value**
Sex				
Male	20.5	79.5	1.0	0.36
Female	18.5	81.5	0.9 (0.7 to 1.1)	
Area of residence				
Urban	18.5	81.5	1.0	0.4
Rural	20.5	79.5	1.1 (0.9 to 1.4)	
Chest infection 1st year				
No	17.8	82.2	1.0	<0.001
Yes	48.3	51.7	4.9 (3.0 to 7.9)	
Mother has asthma				
No	17.8	82.2	1.0	<0.001
Yes	44.3	55.7	3.6 (2.4 to 5.4)	
Father has asthma				
No	18.9	81.1	1.0	<0.001
Yes	50.8	49.2	4.3 (2.4 to 7.9)	
Either parent has asthma				
No	16.8	83.2	1.0	<0.001
Yes	45.5	54.5	4.1 (2.8 to 5.8)	
Allergies				
Eczema				
Never	16.4	84.6	1.0	<0.001
Ever	34.1	65.9	2.7 (1.9 to 3.7)	
Hay fever				
Never	13.8	86.2	1.0	<0.001
Ever	36.8	64.2	3.8 (2.9 to 4.9)	
Rhinitis				
Never	12.6	87.4	1.0	
Ever	40.9	59.1	5.0 (3.8 to 6.5)	<0.001
Rhinitis in the last 12 months	44.3	55.7	5.7 (4.3 to 7.6)	<0.001
Breast feeding				
6–12 months	18.5	81.5	1.0	
>12 months	22.3	77.8	1.3 (0.9 to 1.9)	0.20
<6 months	22.4	77.6	1.2 (0.8 to 1.8)	0.28
Never	17.7	82.4	1.0 (0.5 to 1.9)	0.95
Moulds in the home				
No	23.1	76.9	1.0	<0.01
Yes	42.6	58.4	2.2 (1.2 to 4.3)	
Attended day care facility				
No	19.6	79.4	1.0	0.97
Yes	19.7	79.3	1.01 (0.8 to 1.3)	
Pets in the home at 1st year				
Dog				
No	15.7	84.3	1.0	0.02
Yes	26.3	73.7	1.7 (1.2 to 2.2)	
Cat				
No	15.8	84.2	1.0	0.004
Yes	29.1	71.9	1.8 (1.2 to 2.7)	
Pets in the home at present				
Dog				
No	15.8	84.2	1.0	0.002
Yes	25.5	74.5	1.6 (1.2 to 2.1)	
Cat				
No	15.8	84.2	1.0	<0.001
Yes	32.6	67.4	2.2 (1.5 to 3.2)	

Continued

Table 6 Continued

Risk factor	Current wheeze			
	Yes (%)	No (%)	OR (95% CI)	p Value
Maternal smoking				
Not in pregnancy	19.3	80.7	1.0	0.16
During pregnancy	27.9	70.7	1.6 (0.8 to 3.1)	
1st year of life				
No	19.3	80.7	1.0	0.23
Yes	26.8	73.2	1.5 (0.8 to 2.9)	
Smoker in the household				
No	19.3	80.7	1.0	0.77
Yes	20.2	79.8	1.1 (0.8 to 1.4)	
Mother's age at birth (years)				
≥30	20.0	80.0	1.0	
15–19	19.2	80.8	0.9 (0.6 to 1.5)	0.83
20–29	20.3	79.7	1.0 (0.7 to 1.5)	0.89
Birth weight				
2500–3499	18.9	81.1	1.0	
>2500	23.2	77.8	1.3 (0.8 to 2.2)	0.30
≥3500	22.4	77.6	1.3 (0.9 to 1.9)	0.23

The age of children included in this study may have contributed to the high prevalence of current wheeze. The study sample included children <3 years of age some of whom may have had transient wheeze associated with viral infections.[36] However, while current wheeze was more prevalent in 2–4-year-olds (27.8%) compared with older age groups, the prevalence of current wheeze was still high when both the 6–7-year-olds (22.4%) and 13–14-year-olds (18.5%) were examined separately, and respiratory infections during the first year of life were associated with more than four times the risk for asthma (OR 4.83, 95% CI 3.00 to 7.77). There is also evidence suggesting wheezing in early infancy due to viral infections is a strong predictor of school-age asthma.[36] The finding that more males than females had higher prevalence of current wheeze and doctor-diagnosed asthma is consistent with findings of other studies which reported sexual dimorphism in the prevalence of asthma in childhood and adolescence related to physiological differences between males and females.[37]

Finally, some authors attributed the increase in the risk of asthma in low- and middle-income countries to urbanisation and adoption of modern lifestyles leading to changes in diet, physical activity and psychosocial stress including violence as well as exposure to indoor and outdoor pollutants, irritants and aeroallergens.[38–40] Cooper and colleagues[38] attributed the high prevalence of asthma in Latin America to the processes of urbanisation and adoption of modern lifestyles which has an impact on the environment, living conditions and health status of the population. Jamaica, like many Latin American countries, is also experiencing rapid urbanisation and modernisation related to economic development.[35] Follow-up studies should examine the relationship between asthma and lifestyle factors such as diet, physical activity as well as obesity and broader social issues such as psychosocial stress including violence, factors that were not examined in this study, which may contribute to high prevalence of asthma symptoms in this population.

Strengths and limitations of the study

A major strength of this study is the use of an internationally standardised ISAAC questionnaire in a nationally representative sample with a high response rate of 80%, which enabled us to obtain credible prevalence estimates. We used a modified ISAAC protocol in which we sampled from households rather than schools, and within each household, we sampled one child and one adult. This approach enabled us to obtain prevalence estimates for both adults and children in one survey, thereby reducing the cost of such surveys. This approach would be particularly useful in other resource poor countries.

The main limitations of this study is the fact that the prevalence of both asthma and allergies is based on self-reports of symptoms which may have resulted in an overestimate of the actual prevalence. Objective tests for asthma, skin reactivity and tests for IgE were not done to confirm either asthma or atopy. Another limitation of this study is the fact that caregivers of children younger than 12 years responded to the questionnaire. It has been suggested that prevalence estimates may be influenced by the caregivers understanding of the term 'wheeze', which may result in information bias.[41] However, in a study involving pre-adolescents, Decker and colleagues[42] reported agreement in responses between pre-adolescents and their parents for current asthma symptoms. In another study involving adolescents,[43] self-reports of current asthma symptoms were higher than those reported by parents. Also in this study, the question on 'asthma ever' was modified consistent with terminology used locally. This change was validated locally and when compared with medical records, there was substantial agreement with a κ statistic for 'asthma ever' of 0.816.

Table 7 Adjusted OR (95% CI) for risk factors associated with current wheeze

	Current wheeze			
Risk factor	**Yes (%)**	**No (%)**	**OR (95% CI)**	**p Value**
Chest infections in the 1st year				
No	17.8	82.2	1.0	<0.001
Yes	48.3	51.7	4.8 (3.0 to 7.9)	
Mother has asthma				
No	17.8	82.2	1.0	<0.001
Yes	44.3	55.7	3.7 (2.4 to 5.7)	
Father has asthma				
No	18.9	81.1	1.0	<0.001
Yes	50.8	49.2	4.5 (2.5 to 8.1)	
Either parent has asthma				
No	16.8	83.2	1.0	<0.001
Yes	45.5	54.5	4.2 (2.9 to 6.1)	
Eczema ever				
Never	16.4	84.6	1.0	<0.001
Ever	34.1	65.9	2.6 (1.8 to 3.5)	
Allergies				
Hay fever				
Never	13.8	86.2	1.0	<0.001
Ever	36.8	64.2	4.8 (3.6 to 6.4)	
Rhinitis				
Never	12.6	87.4	1.0	
Ever	40.9	59.1	6.0 (4.6 to 7.9)	<0.001
Rhinitis in the last 12 months	44.3	55.7	6.9 (5.2 to 9.3)	<0.001
Moulds in the home				
No	23.1	76.9	1.0	<0.017
Yes	42.6	58.4	2.3 (1.2 to 4.45)	
Pets in the home				
Dog in 1st year				
No	15.7	84.3	1.0	<0.001
Yes	26.3	73.7	1.8 (1.3 to 2.5)	
At present				
No	15.8	84.2	1.0	<0.006
Yes	25.5	74.5	1.8 (1.2 to 2.8)	
Cat in 1st year				
No	15.8	84.2	1.0	<0.001
Yes	29.1	71.9	2.0 (1.4 to 3.1)	
At present				
No	15.8	84.2	1.0	<0.001
Yes	32.6	67.4	2.4 (1.7 to 3.6)	

Sensitivity and specificity of the questionnaire for a history of asthma were 93% and 90%, respectively. Nevertheless, this adjustment may still have yielded an overestimate of the prevalence of this variable. However, prevalence estimates were based on symptoms such as 'wheezing in the last 12 months', which are deemed more accurate and not subject to recall bias.[44]

Conclusions

The prevalence of asthma and allergies in Jamaican children is high and comparable to that observed in high-income countries. This presents a public health challenge with a potential for high healthcare system costs related to asthma morbidity. Significant risk factors for asthma in this population were a family history of asthma, chest infections in the first year of life, allergies, moulds and pets in the home. A multidisciplinary approach targeting children at high risk for asthma and controlling modifiable risk factors is necessary for prevention and reducing the prevalence and morbidity related to asthma.

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