ERJ Express. Published on May 31, 2006 as doi: 10.1183/09031936.06.00089005

Prevalence and socioeconomic associations of asthma and allergic rhinitis in Cairo, Egypt

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Short title: Asthma and allergic rhinitis in Cairo

WORD COUNT: Article 3079; abstract 200

Abstract

QUESTIONS OF STUDY: 1-What is the prevalence of asthma and allergic rhinoconjunctivitis symptoms in Cairo? 2-What are the socioeconomic factors associated with symptom prevalence and severity?

METHODS: Translated and adapted version of the ISAAC questionnaire was distributed to a sample of 2645, 11-15yr olds in state and fee paying schools in Cairo.

RESULTS: Overall prevalence of wheeze ever, wheeze during the last year and physician diagnosed asthma were 26.5% (697/2631), 14.7% (379/2570), 9.4% (246/2609). Prevalence of rhinoconjunctivitis was 15.3% (399/2616). Asthma symptoms were independently associated with attendance at a state school, parental asthma, age, history of rhinitis and owning a pet cat. Rhinoconjunctivitis was independently associated with attendance at a state school, father's education, parental history of asthma, asthma symptoms and owning a pet cat. In spite of a higher prevalence of severe asthma symptoms in state schools prevalence of physician diagnosis of asthma was the same in both school types suggesting inequalities in access to health care.

ANSWER TO QUESTIONS: Prevalence of physician diagnosed asthma in Cairo was 9.4%, prevalence of rhinoconjunctivitis was 15.3%. There is a higher prevalence and increased severity of asthma symptoms in children of lower socioeconomic group as defined by state school attendance in Cairo.

Key words: allergic rhinitis, asthma epidemiology, Cairo, population health, socioeconomic, wheeze.

Introduction

The prevalence of asthma and allergic rhino-conjunctivitis is high in Western countries, and has been rising throughout the late 20th Century. However relatively little is known about the prevalence of allergic disorders in children in North Africa and the Middle East, and even less is known about the relative importance of socioeconomic factors in its aetiology in these countries, when compared to Europe, the United States and Australia.

Comparisons between the International Study of Asthma and Allergies in Childhood (ISAAC) prevalence results and another international study, the European Community Respiratory Health Survey results have shown that although there are some differences in the absolute prevalence levels, there is good agreement of patterns between countries.[1] There are several hypotheses in the literature on the aetiology of asthma, many of which have been investigated in phase 2 and 3 of the ISAAC study.[2]

The role of socioeconomic factors in the aetiology of asthma is not simple. The 'hygiene hypothesis' suggests that higher standards of hygiene and cleanliness have reduced the chance for cross infection in childhood and increased the risk of atopic sensitisation.[3]

Although 'poor' and 'richer' children living in urban environments may be equally less exposed to faeco-oral pathogens than in the past – 'poorer' children may still have higher exposure to many risk factors facilitating severe asthma and wheezing. Such risk factors may include airborne viruses, smoke, indoor dampness, cockroaches and poor access to healthcare.[4,5]

It has consistently been found that people from low socioeconomic backgrounds tend to have a higher prevalence of severe asthma symptoms even if the overall prevalence is no different to the rest of the population.[5,6,7]

There have been very few studies of the epidemiology of asthma and allergic rhinitis in Egypt. Egypt has been classified as a middle income country by the World Bank, but there is still a substantial amount of poverty and adult illiteracy is still high.[8, 9]

There is an urgent need to obtain more data on the allergic and asthma epidemic from middle income countries as the economic transition period may have dramatic effects on health which could be affected by policy change.

The aims of this study are to determine the prevalence of asthma and allergic rhinoconjunctivitis in school-children in Cairo and to investigate the role of socio-economic status on prevalence of asthma and allergic rhinoconjunctivitis.

Materials and Methods

Study subjects

The study population was taken from 11 to 15 year old children in the first and second years of preparatory secondary school in the El Nozha area of Cairo, Egypt. These schools comprise state schools, experimental language schools and private schools. Experimental Language schools are fee-paying government schools and are classified with private schools in the analysis.

The El Nozha area education office provided a list of the local schools and gave written permission for the research to take place. Two sampling frames were created, one with

state-run and another with private schools. A selection of schools was made from each list until there were enough pupils enrolled. Two experimental schools (n=487), three private schools (n=622) and three state schools (n=1536) were included. Only one of the schools initially approached refused to take part in the study and so another school from the same sampling frame was chosen.

From an estimated school roll of 20,000, and underlying prevalence of asthma at 10%, 2,144 participants were required to have 80% power to estimate prevalence of asthma to within 1.2% of the true value with 95% confidence.

In the absence of a formal research ethics mechanism covering schools in Cairo, South Birmingham Research Ethics Committee was approached and gave notional permission for the study to be carried out. Permission from the school head teacher was obtained. Then information letters and consent forms were sent out to parents of the children a few days before the study questionnaire was administered. 54 of the children in the study sample (1.8%) were withdrawn from the study by their parents.

Study Design

An adapted version of the ISAAC questionnaire was used to measure the symptom prevalence. The independent variable was the school type. Questionnaire delivery was controlled. Use of the ISAAC video was not within the resources available.

Methods

Apparatus

The study used an Adapted ISAAC questionnaire comprising four sections: demographic information, breathing problems, nose problems and home environment.

Development of study instrument

The study questionnaire was developed using questions from the ISAAC phase 1 questionnaire.[10] Questions were asked about symptoms of asthma and allergic rhinitis as well as the home environment. In addition some questions on socioeconomic status were added and piloted.

The questionnaire was translated into Arabic by an independent translator. Then the translation was revised by H.F and M.E.G. Phrases that were difficult for children to understand were changed and if there was no suitable word for them a verbal explanation was added as part of the study guidelines. Then the questionnaire was back translated by a second independent translator.

56 children were involved in the piloting process. These were recruited from sunday school classes in the region and the final pilot was a class from a school in the sampling frame. As a result of the pilot, weaknesses in questions and confusing formatting were identified and corrected. Language problems were also noted and a standardised verbal explanation was added to the study guidelines. The verbal explanation was given by two researchers V.G. and M.E.G – this was standardised as far as possible using a protocol including the main points and phrases to be used.

Data collection took place between February to April 2003. Each school was visited twice, once to obtain the headteacher's permission and to distribute consent letters. On the second visit the questionnaires were filled in by the children. This was under the supervision of trained field workers who followed a study protocol.

Analysis

A code was added to each questionnaire for school, year and class, and each was given a questionnaire ID. A coding manual was developed and data was entered into SPSS version 11.

Bivariate analysis was performed on all potential risk factors for asthma, allergic rhinitis and severity of asthma using the chi-squared test. All variables that were significantly associated with symptoms were entered into a multiple logistic regression analysis model to assess factors independently associated with the following outcomes: Wheeze in the last 12 months, severe asthma symptoms, nose problems in the last 12 months and allergic rhinoconjunctivitis (nose problems last 12 months+ itchy watery eyes). Severe asthma was defined as having one or more of the following: wheeze that awakens me more than once a week, wheeze that hinders ability to talk or wheeze that limits daily activity a lot. Allergic rhinoconjunctivitis was defined as presence of itchy, watery eyes associated with nose symptoms.

Results

The final number of completed questionnaires in the age range 11-15yrs was 2645 questionnaires. 3002 children were eligible to receive a questionnaire. Of these 2645 (88.1%) completed questionnaires were received. 303 were absent on the day of data collection and 54 children were withdrawn by their parents from the study or handed in "spoiled questionnaires". 31 questionnaires were excluded as subjects were outside the study age range.

Demographic characteristics of responders

50.1% (1325) of respondents were male and 49.8% (n=1316) were female. Other demographic characteristics are included in table 1.

To make the best use of the data all available responses were used in the analysis, so the total number of respondents may vary between analyses of individual risk factors.

Prevalence of symptoms

Overall the prevalence of wheeze ever, wheeze during the last year and physician diagnosed asthma was 26.5% (697/2631), 14.7% (379/2570), 9.4% (246/2609).

The overall prevalence of allergic rhinitis nose symptoms, allergic rhinoconjuntivitis and physician diagnosis of allergic rhinitis was 40.0% (1055/2637), 15.3% (399/2616) and 10.8% (282/2621).

Socioeconomic status

The following characteristics were used to define socioeconomic status: attendance at a fee-paying school versus a free state school, level of education of father and level of education of mother. Information was also collected on occupation, but this was incomplete and not used in analysis.

Bivariate Analysis

Table 2 shows that children from state schools had a higher prevalence of all symptoms than those in fee-paying schools. State school children had a higher past year wheezing prevalence than children in fee-paying schools (18.8% and 9.1% respectively) and more exercise induced wheeze (35.6% and 18.6% respectively). Nocturnal cough had a high prevalence in both groups but was also higher in state school children (54.2% vs 30.9%). Allergic rhinitis showed higher prevalence in state schools than in fee-paying schools (44.7% vs 33.5%) and the same was true for rhino conjunctivitis (21.1% vs 7.2%). However there was no difference in prevalence of physician diagnosis of asthma or allergic rhinitis between the two groups.

Symptoms were also more prevalent in those children whose mother or father had not received university level education.

Table 1. Prevalence of Asthma and allergic rhinitis symptoms by socioeconomic status

		Respiratory Symptoms					Nose Symptoms	
		Ever experienced wheeze	**Wheeze during past year**	**Severe asthma symptoms**	**Exercise related wheeze**	**Wheeze in absence of a cold**	**Nose problems in the last year**	**Itchy watery eyes**
School type	**Fee paying school (%)** (n=1109)	197 (17.9)	98 (9.1)	54 (4.9)	204 (18.6)	71 (6.4)	369 (33.5)	79 (7.2)
	State school (%) (n=1536)	500*** (32.7)	281*** (18.8)	200*** (13.1)	540*** (35.6)	201*** (13.2)	686*** (44.7)	320*** (21.1)
	Missing (%)	14 (0.5)	75 (2.8)	17 (0.6)	31 (1.2)	20 (0.8)	8 (0.3)	29 (1.1)
Father's education	**University or above (%)** (n=1960)	439 (22.8)	221 (11.7)	136 (7.1)	470 (24.5)	160 (8.3)	706 (36.6)	223 (11.6)
	High School or less (%) (n=661)	245*** (37.8)	152*** (23.9)	114*** (17.6)	256*** (39.8)	105*** (16.3)	326*** (50.0)	165*** (25.7)
	Missing	68 (2.6)	127 (4.8)	71 (2.7)	83 (3.1)	74 (2.8)	62 (2.3)	83 (3.1)
Mother's education	**University or above (%)** (n=1794)	402 (22.8)	203 (11.8)	124 (7.0)	429 (24.4)	146 (8.3)	651 (36.8)	206 (11.7)
	High School or less (%) (n=790)	273*** (35.2)	164*** (21.6)	120*** (15.5)	286*** (37.0)	118*** (15.3)	363*** (46.5)	176*** (22.9)
	Missing	103 (3.9)	160 (6.0)	107 (4.0)	118 (4.5)	110 (4.1)	98 (3.7)	118 (4.5)

χ^2 significance: ***P<0.001 for difference between school type or education level

Severity of symptoms

Children from state schools had a higher prevalence of severe asthma symptoms than those in fee paying schools (13.1% vs 4.9%), $p<0.001$. The proportion of individuals with severe asthma symptoms without a diagnosis of asthma is higher in state schools than in fee-paying schools (63.3% of those with severe symptoms vs 29.6% respectively, $p<0.001$.) Severity is also higher in children whose parents have not had university level education.

Wheeze during the last year

All the variables that were significantly associated with symptoms in the bivariate analysis were included in the multiple logistic regression models. Results are shown in Table 2. The number of siblings that a respondent had was not included as it was not significant in the bivariate analysis.

Factors that strongly associated ($p<0.001$) with having wheeze during the past year were; a parent with asthma, nose symptoms during the past year, rhino conjunctivitis and physician diagnosed rhinitis. Adjusted odds ratios and confidence intervals of comorbidities respectively were 1.87 [1.33-2.64], 1.86 [1.38-2.52], 2.45 [1.78-3.38], 2.26 [1.63-3.13]. Age and school type were less strongly associated with wheezing during the last year. There was also an association ($p<0.05$) between having a cat in the house and wheeze.

Severe asthma symptoms

Results are shown in Table 2.

Factors strongly associated ($p<0.001$) with having severe asthma symptoms were; a parent with asthma, rhino-conjunctivitis and physician diagnosed rhinitis. Adjusted Odds

ratios and confidence intervals of the latter two variables were 2.48 [1.71-3.58] and 3.01 [2.10-4.32]. Other significant associations with severe asthma symptoms were nose symptoms during the past year ($p<0.01$ adjusted odds ratio 1.79 CI [1.23-2.59]) and age ($p<0.05$). Having a cat in the house was not associated with severe asthma symptoms.

Nose symptoms

Results are shown in table 2.

Wheezing during the last year was strongly ($p<0.001$) associated with nose symptoms adjusted odds ratio 2.09 CI[1.41-3.11]. Having someone who smokes in the house was also strongly associated with nose symptoms ($p<0.01$). There was an association between nose symptoms and school type ($p<0.01$) and between rhinoconjunctivitis and school type ($p<0.001$) with children from state schools having a higher risk of nasal symptoms and rhinoconjunctivitis. There were also significant ($p<0.05$) associations between nose symptoms and father's education, parental history of asthma, age, having a cat in the house and physician diagnosed asthma.

Table 2. Multivariate analysis for prevalence of nose symoptoms, rhinoconjunctivitis, wheeze in the last 12 months and severe asthma symptoms

	Nose symptoms in last year			**Rhinoconjunctivitis**			**Wheeze in last year**			**Severe Asthma Symptoms**	
	Adjusted Odds Ratio	**95% Confidence Intervals**		**Adjusted Odds Ratio**	**95% Confidence intervals**		**Adjusted Odds Ratio**	**95% Confidence Intervals**		**Adjusted Odds Ratio**	**95% Confidence intervals**
State School	1.36**	(1.11-1.68)		2.69***	(1.94-3.73)		1.68**	(1.23-2.31)		1.99**	(1.34-2.95)
Father's education	1.42*	(1.04-1.95)		1.61*	(1.07-2.43)		1.30	(0.86-1.96)		1.37	(0.86-2.24)
Mother's education	0.77	(0.57-1.04)		0.75	(0.49-1.13)		1.09	(0.72-1.64)		1.10	(0.68-1.79)
Parental asthma	1.45	(1.09-1.94)		1.63**	(1.15-2.32)		1.87***	(1.33-2.64)		2.00***	(1.36-2.94)
Age 1+	1.22	(0.95-1.58)		-	-		1.86**	(1.21-2.85)		1.72*	(1.03-2.87)
Age 2+	1.23	(0.94-1.60)		-	-		2.25***	(1.45-3.49)		2.10**	(1.24-3.55)

Age 3+	1.37	(0.92-2.03)		-	-		2.06*	(1.16-3.67)		2.41*	(1.24-4.68)
Age 4+	3.39	(1.12-10.19)		-	-		3.04*	(1.00-9.19)		3.45*	(1.05-11.37)
Pet cat	1.46*	(1.03-2.03)		1.20	(0.77-1.89)		1.61*	(1.02-2.52)		1.35	(0.79-2.29)
Any Pets	1.05	(0.85-1.30)		1.38*	(1.03-1.86)		1.00	(0.73-1.36)		1.01	(0.70-1.46)
Smoker in house	1.39**	(1.15-1.63)		1.42**	(1.10-1.83)		1.03	(0.80-1.33)		1.06	(0.78-1.44)
Male Gender	-	-		0.65**	(0.50-0.83)		1.24	(0.97-1.59)		-	

***p<0.001, **p<0.01, *p<0.05

\+ ages 12, 13, 14 and 15 respectively compared with all other ages . Father's and mother's education compare education at University level or above with education below University level

Rhinoconjunctivitis

Results are shown in Table 2.

Wheezing during the last year and having a smoker in the house were associated with rhinoconjunctivitis ($p<0.001$; adjusted odds ratio 2.61 CI [1.63-4.17] and $p<0.01$ respectively). Severe asthma symptoms were also associated with rhinoconjunctivitis

$p<0.05$ adjusted odds ratio 1.72 CI [1.03-2.89]. Children from state schools were 2.7 times more likely to have rhino conjunctivitis than those from fee-paying schools.
Although having a cat was not a significant risk factor for rhino-conjunctivitis having any pets was. The number of siblings was included in the multivariate analysis but was not found to be significant.

Discussion

This study has established the prevalence of asthma symptoms, nasal symptoms and symptoms of allergic rhinoconjunctivitis in this relatively affluent area of Cairo. It has also shown a definite association between asthma and allergic rhinitis symptoms and social class. People from lower income families (as defined by school type) were one and a half times more likely to have had wheeze during the last year and twice as likely to have had severe symptoms as people from a higher socioeconomic background. In addition children from state schools were two and a half times more likely to have rhinoconjunctivitis than their colleagues in private schools.

Prevalence of symptoms

The international literature shows that asthma prevalence differs between countries with higher rates in more affluent countries [11, 12, 13]. Table 3 illustrates some of the variation between countries in the middle east, our study and the UK.

Table 3. Prevalence of Rhinoconjunctivitis, recent wheeze and physician diagnosed asthma in the Middle East and the UK.

	Rhinoconjunctivitis (%)	Wheeze in the last 12 months (%)	Physician diagnosed asthma (%)
Cairo study	**15.3**	**14.7**	**9.4**
UK[10,14]	18.2	33.3	20.9
Israel [15, 16]	15.8	20.1 (Jewish) 10.1 (Arab)	7.8 (Jewish) 4.9 (Arab)
Palestine (refugee camps) [17]		8.8	9.4
Oman[18]	10.5	8.9	20.7
Saudi[19]	12.5	11.2	12.1
	13.9 (urban) 8.0 (rural)	13.2 (urban) 6.4 (rural)	15.1(urban) 5.0 (rural)
Kuwait[20]		16.1	16.8

The prevalence of rhinoconjunctivitis, recent wheeze and physician diagnosed asthma in all of the Middle Eastern countries is lower than in the UK. The prevalence of physician diagnosed asthma in our study in Cairo is the lower end of the spectrum for the region.

The influence of socioeconomic factors

This study demonstrated a significant association between socio-economic status and symptoms, with both higher prevalence and severity found in the lower socio-economic group.

Within Israel, comparisons between Arab and Jewish children found that Jewish children have double the prevalence rate for current wheeze as Arab children (20.7% vs 10.1%).[16] This is in an environment where the Arab community tend to be poorer and have worse living conditions than the Jewish community.[16] However within Palestinian refugee camps the prevalence of asthma was similar to that found in Cairo.[21] On the other hand this study found a higher prevalence of wheezing in the last 12 months and diagnosed asthma in the westernized district of Ramallah, than in North Gaza.[21] This picture would seem to suggest that within communities, socio-economic status is associated with asthma symptoms, but between communities with different lifestyles, asthma symptom prevalence is higher in affluent areas. This latter picture is consistent with the hygiene hypothesis and the picture of asthma prevalence in Europe.[13, 22, 23]

In Saudi Arabia[19] although the symptom prevalence is lower than that found in Cairo, the prevalence of physician diagnosed asthma is higher which may be due to a discrepancy of health care in the two countries.

In a study of 4300, 7-15 year old boys in Saudi Arabia, lower monthly family income was associated with having asthma.[24] A study in Norway also found that markers of low socioeconomic status were associated with asthma in young children.[4] These findings are in common with results of asthma studies in Chicago in the United States that have found that asthma in the inner cities is more prevalent and severe than the rest of the country.[25]

Alternative hypotheses need to be sought regarding environmental exposures that might explain the complex relationship between socio-economic status and prevalence of asthma and allergic rhinitis in different countries, communities and cultures. Of particular interest is the consistent association between cockroach allergen and asthma symptoms. [26,27]

It has been shown that high levels of cockroach allergen seem to be associated with lower socioeconomic status.[28] In addition the association between cockroach allergen in the family room and repeated wheezing during childhood has been shown to be significant even after adjusting for socioeconomic factors [25]

The environment in Egypt encourages cockroaches to thrive and it is possible that this is a significant contributor to asthma prevalence in the lower socioeconomic groups.

Severity of asthma symptoms

This study also showed a difference in symptom severity between socioeconomic groups. Not only were the rates of severe asthma symptoms higher in the lower socioeconomic group, but among children with severe asthma symptoms a higher proportion of those from state schools did not have a physician diagnosis of asthma than those from fee paying schools (63% versus 30%).

This is an important finding. It suggests that children from poorer families do not have access to health care, and thus do not receive a diagnosis of asthma, nor do they receive appropriate treatment for it. This agrees with the UK findings of Duran Tauleria et al[5] that children from inner cities whose father's social class was low and who lived in a

poor area had a higher prevalence of persistent wheeze than children in the rest of the sample. Similar findings of higher levels of severe asthma among lower socioeconomic groups have been described elsewhere. [6,7]

It seems likely that the discrepant findings of this study – higher prevalence of and greater severity of symptoms in poorer children, but with no difference in prevalence of diagnosed asthma is at least in part due to discrepancies in access to health care.

Limitations of study

Translation of the ISAAC questionnaire into Arabic is difficult. Although there is a medical word for wheezing in the Arabic language it is not widely understood by the age group of the study. As a result, two researchers gave a verbal description of wheezing in every classroom, a study protocol was used to maximise consistency.

The proportion of the total child population attending school in Cairo is not known with accuracy. As 42% of the population is illiterate,[9] this suggests that a substantial minority of younger children may not attend school. However local informants suggested that the rate of non-school attendance was likely to be lower in the city of Cairo than in other parts of Egypt, so it is difficult to estimate the effect that this might have on our prevalence results.

Conclusion

In conclusion, in Cairo, Egypt, the overall prevalence of wheezing in the last year was 14.7% and physician diagnosed asthma was 9.4% among 11 to 15 year old school children. This study clearly shows that allergic rhinoconjunctivitis and asthma symptoms

have much higher prevalence in those from poorer backgrounds. Children attending state schools also showed a higher prevalence of severe asthma symptoms but were much less likely to have a physician diagnosis of asthma, which points to discrepancies in access to health care. Asthma is relatively common, and probably under-diagnosed and under-treated, particularly among children from less wealthy families in Cairo.

In this middle income country, economic growth and the associated improvement in housing and sanitation has resulted in fewer childhood gastrointestinal infections. The loss of this protective effect against atopy in the city may have contributed to an increased prevalence of atopic symptoms. This evidence suggests a worldwide expansion in the allergy epidemic.

Acknowledgements

I would like to thank all the children who filled in the questionnaires and all the people who were so helpful with the field work especially Dr Sherly Rizkallah. I would also like to thank Tim Marshall for his support in all ethical matters.

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