Risk factors associated with hospital emergency visits among asthmatic schoolboys in Saudi Arabia

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عوامل الاختطار المرافقة للزيارات الإسعافية للمستشفيات من قِبَل أطفال المدارس المصابين بالربو في المملكة العربية السعودية

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الخلاصة: أُجريت هذه الدراسة المستعرضة لتحديد معدلات الانتشار لسوابق زيارات إسعافية للمستشفيات من قِبَل أطفال المدارس المصابين بالربو في المملكة العربية السعودية، وقد جُمعت المعطيات باستخدام استبيان يُستكمل ذاتيا من قِبَل الوالدين. إن معدل انتشار سوابق زيارات إسعافية للمستشفيات من بين أطفال المدارس الذين شُخّصوا بأنهم مصابون بالربو بواسطة الاستمارات كان 65%، وتم تحديد العوامل التي رافقت إيجابية سوابق زيارات إسعافية للمستشفيات من بين أطفال المدارس الذين شُخّصوا بأنهم مصابون بالربو بواسطة الاستمارات، ومن المتوقع أن يؤدي تعديل العوامل التي يمكن الوقاية منها إلى إنقاص الإجمالي عدد الزيارات لغرف الإسعاف في المستشفيات وإنقاص شدة المرض ومدى العجز الناجم عنه.

ABSTRACT This cross-sectional study was carried out to determine the prevalence of a positive history of hospital emergency visits (HHEV) among asthmatic Saudi schoolboys. Data were collected using self-administered questionnaires to parents. The prevalence rate for positive HHEV among questionnaire-diagnosed asthmatic boys (QDAs) was 65.0%. Factors associated with positive HHEV among QDAs were determined. Modifying the preventable factors associated with the total number of hospital emergency room visits is expected to decrease the severity and the disability of this disease.

Facteurs de risque à l'origine d'une consultation en urgence à l'hôpital chez des écoliers asthmatiques en Arabie saoudite

RESUME Cette étude transversale a été réalisée pour déterminer la prévalence d'antécédents de consultations dans les services des urgences à l'hôpital chez des écoliers asthmatiques en Arabie saoudite. Des données ont été recueillies au moyen de questionnaires remplis par les parents. Le taux de prévalence d'antécédents de consultations aux urgences hospitalières chez les garçons asthmatiques identifiés à l'aide du questionnaire s'élevait à 65,0 %. Les facteurs associés à un antécédent de consultation en urgence à l'hôpital chez ces garçons asthmatiques ont été déterminés. En agissant sur les facteurs évitables qui sont associés à la totalité des consultations d'urgences hospitalières, on espère réduire la gravité de la maladie et les incapacités qui y sont liées.

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Received: 05/04/01; accepted: 17/06/01

Introduction

Childhood bronchial asthma is a chronic disease with an increasing prevalence, number of preventable hospital emergency visits and admissions [*1,2*]. In the United States of America, it was found that the annual direct cost to the health care provider of only 1205 asthmatic patients to be US$ 2.5 million [*3*]. The number of repeated hospital emergency visits due to bronchial asthma is considered a reliable indicator of the severity of the disease in the community [*4*]. In addition to emergency room visits and hospitalizations, school absenteeism, as a consequence, is considered to be another valid morbidity marker for asthma [*5,6*]. Children who are frequently absent from school tend to perform poorly and are more likely to drop out before graduation from high school [*7*]. Excessive school absenteeism has also been found to be associated with future unemployment, maladaptive behaviour, wasted opportunities and welfare costs [*7*]. Increased numbers of visits to hospital emergency rooms may signal such health problems as poor coping with, or management of, chronic illnesses such as bronchial asthma. As a tool, frequency and pattern of hospital emergency visits are readily available and easy to use as indicators of possible childhood or/and family dysfunction that may turn out to be due to unmet health needs [*2*].

In Saudi Arabia, a fair number of studies have been conducted to investigate certain aspects of this disease, including prevalence of this health problem among children [*8–15*]. Reports from eastern Saudi Arabia estimated prevalence of bronchial asthma among schoolchildren to be up to 10% [*8,9*] and there is evidence to suggest that prevalence of this disease is increasing [*10*]. Consequently, morbidity and mortality of bronchial asthma continue to increase [*11,12*]. In eastern Saudi Arabia, environmental factors were found to be associated with the etiology of bronchial asthma among schoolchildren [*8,9,13*]. Prevalence of bronchial asthma among Saudi schoolchildren was found to be higher in industrial, agricultural and urban areas as compared to desert and rural areas [*8,14,15*]. However, to the best of the investigator's knowledge, no study has been conducted to determine the prevalence of hospital emergency visits among asthmatic children as an indicator of disability among schoolchildren in Al-Khobar city. Such a study is essential to reflect the severity and disability due to childhood asthma. Factors associated with the frequency of emergency visits will also be determined. This is expected to help in better design and provision of appropriate services to those children and their families.

The objective of this study was to determine the prevalence of a positive HHEV among asthmatic Saudi schoolboys in Al-Khobar city, and to identify risk factors associated with it, during the current academic year of the study. Another objective was to determine factors associated with the total number of hospital emergency room visits (TNHEV) during the same period.

Methods

Saudi boys in elementary and preparatory schools at Al-Khobar city were the subjects of this cross-sectional study, which was conducted over a 15-week period towards the end of the second term of the 1995 academic year. Al-Khobar city is located on the eastern coast of Saudi Arabia. A total of 22 077 schoolboys were identified at elementary [15 829 (71.7%)] and preparatory [6248 (28.3%)] schools in Al-Khobar city.

A sample of 1550 schoolboys (7% of the total schoolboys in the study area) was calculated to be our sample. The sample size determination was based on the usual equation for sample estimation [*16*]. In that equation, 7% was used as the estimated proportion of bronchial asthma among schoolchildren in the study area, based on an earlier study in the region [*11*]. This sample size was determined as that which would give a high precision of the estimate proportion as narrow as ±1% away from the true estimated population proportion. The determined total sample of 1550 schoolboys [elementary = 1110 (71.6%) and preparatory = 440 (28.4%)] was drawn from the total schools through simple random sampling (four elementary and two preparatory schools). The total number of sample students in each school was in accordance with the ratio they represent in relation to the total number of students in all schools (in each level of education). In each school the sample was drawn evenly and randomly from different academic classes. Schoolgirls were not included in this study because of difficulties in gaining access, a limitation that had also previously faced some other investigators [*14*].

The methods used included a self-administered pre-tested and pre-coded questionnaire directed to parents. This questionnaire was previously standardized, validated and applied to the Saudi community [*8,13,14*]. The questionnaire used in this work was subjected to a reliability test based on psychometric analysis using the split-halves method and the general Spearman Brown formula [*17*], which indicated a reliability of 95%.

The definition of asthma used in this study was modified from the United Kingdom Medical Research Council (MRC) definition [*18*]. The criteria selected to identify asthmatic children were as follows: any schoolboy whose parents responded to all of the following questions with "yes" was considered to be a questionnaire-diagnosed asthmatic (QDA), otherwise the child was considered a non-questionnaire diagnosed asthmatic (non-QDA).

1. Has your child ever had an attack of wheezing? (a whistling noise that comes from the chest).
2. Has your child ever had attacks of shortness of breath with wheezing?
3. Does the breathing of your child become normal between attacks?

Each family was classified into upper, middle and lower socioeconomic class based on the aggregate score of the father's education, occupation and income [*19*].

The boys and their parents were requested to give personal data such as age, area of residence, father's education, occupation and income. Data included the history of smoking by any household member and, more specifically, a parental smoking habit. A positive current smoking history was defined as having a smoker in the family during any period of the current academic year. The survey inquired about the history of presence of family pet(s) at home (e.g. bird, cat). The presence of at least one pet at home any time during the current academic year, was considered as a positive history. Data collected also included information about medications that had been used, or which were being used currently or regularly by the child during the current academic year, for how long, and how they were/had been administered. The survey inquired about use of prophylactic medications for asthma by the QDAs. "Ever use" prophylactic medication(s) was defined as the positive history of using at least one prophylactic medication during the current academic year.

Absence of such history was considered as "never use". Histories pertaining to frequencies of and reasons for school absenteeism, hospital admissions, emergency room visits during the current academic year were also collected. HHEV was considered positive when at least one hospital emergency visit was recorded during the current academic year. TNHEV was defined as the actual frequency (number) of visits to the hospital emergency room per case during the current academic year. "Ever admitted to hospital" was defined as at least one hospital admission due to bronchial asthma during the current academic year. "Never visited emergency" and "never admitted to hospital during the current academic year" were defined as absence of such specific histories. Total period of school absenteeism (TPSA) was defined as the actual period (in days) of school absenteeism per schoolboy during the current academic year, and the school records were checked for the exact period. Mean period of school absenteeism (MPSA) was calculated as the average period (in days) of school absenteeism in each group.

The statistical program SPSS/PC+ [*20*] was used to calculate chi-squared differences and to assess the statistical significance of contingency tables. The *t*-test was used to test the differences between the two means. Multiple linear regression analysis was used to analyse the data. TNHEV during the current academic year was the dependent variable. The independent variables consisted of: age of the child (in years), socioeconomic class (coded as lower = 1, middle = 2, upper = 3), histories of presence of pet at home (coded as no = 1, yes = 2), presence of a family member at home who was a smoker (coded as no = 1, yes = 2), presence of a smoking father at home (coded as no = 1, yes = 2). They also included histories of admission to hospital (coded as never = 1, ever = 2) due to bronchial asthma; and the history of use of prophylactic medication(s) (coded as never = 1, ever = 2). The stepwise method was used to determine the final multiple regression model. A test was considered statistically significant at $P < 0.05$.

Results

Sample characteristics

A total of 1550 schoolboys were included in this study. The total of returned filled-out questionnaires was 1482, a response rate of 95.6%. Twenty-one schoolboys (1.4%) were excluded from the study because they did not live in Al-Khobar city. The remaining 47 students (3.0%) declined to participate for reasons not related to the study.

The cumulative prevalence of QDA in the total sample was 9.5% (141/1482). The ages of the boys ranged from 6 to 15 years. The mean age of the schoolboys in the total sample was 10.7 ± 3.1 years. There was no statistical difference in mean age among QDAs (10.3 ± 2.1 years) and non-QDAs (10.3 ± 2.2 years), ($t = 0.54$, $P > 0.58$).

A total of 223 (15%) schoolboys were found to belong to upper socioeconomic class families compared with 756 (51%) and 503 (34%) in the middle and lower socioeconomic classes, respectively. No statistically significant difference was found among QDAs and non-QDAs regarding their socioeconomic class distribution ($\chi^2 = 3.46$, $P = 0.12$) (Table 1). MPSA among QDAs was 13.6 ±3.4 days compared to 3.7 ± 2.2 days among non-QDAs ($t = 33.8$, $P < 0.0001$) (Table 1).

Table 2 shows the sample rate of having pets at home among QDAs to be 51.1% while the rates of presence of a smoking

Table 1 **Sample characteristics of the schoolboys with questionnaire-diagnosed asthma (QDA) and those with non-questionnaire-diagnosed asthma**

Variable	Schoolboys with QDA (*n* = 141) No.	%	Non-QDA (*n* = 1341) No.	%	*P*-value
Age group (years)					0.90
6<9	47	33.3	430	32.1	
9<12	45	31.9	443	33.0	
12<15	49	34.8	468	34.9	
Socioeconomic class					0.12
Upper	22	15.6	201	15.0	
Middle	62	44.0	694	51.8	
Lower	57	40.4	446	33.2	
Period of absenteeism (days)[a]	13.6 ± 3.4		3.7 ± 2.2		< 0.0001

s = *standard deviation.*
[a]*Mean ± standard deviation.*

family member and father were 61.0% and 53.9%, respectively. Only 36.9% of QDAs were found to have ever used prophylactic medication(s). There were 170 hospital emergency visits in the sample during the current academic year. The rate of QDAs who had positive HHEV was 65.2% (92/141). Fifty-one boys (55.4%), 23 (25%), 13 (14.1%) and 5 (5.4%) visited the hospital emergency room once, twice, three times and four to nine times, respectively. The rate of those who were ever admitted to hospital (at least once), due to bronchial asthma in this study was 12.1% (17/141). There was a statistically significant difference in MPSA during the current academic year among those with positive (15.3 ± 3.6 days) and negative (9.4 + 2.9 days) HHEV ($t = 10.6$, $P < 0.0001$) (Table 2).

Table 2 **Comparison of history of hospital emergency visits and characteristics of schoolboys with questionnaire-diagnosed asthma**

Variable	Hospital emergency visits: Yes (*n* = 92) No.	%	No (*n* = 49) No.	%	*P*-value
Age group (years)					< 0.0001
6<9	42	45.7	5	10.2	
9<12	31	33.7	14	28.6	
12<15	19	20.6	30	61.2	
Socioeconomic class					< 0.0001
Upper	7	7.6	15	30.6	
Middle	39	42.4	23	46.9	
Lower	46	50.0	11	22.5	
Pets at home					< 0.0001
Yes	58	80.6	14	19.4	
No	34	49.3	35	50.7	
Smoking by father					< 0.0001
Yes	63	82.9	13	17.1	
No	29	44.6	36	55.4	
Smoking by a family member					< 0.0001
Yes	67	77.9	19	22.1	
No	25	45.5	30	54.5	
Hospital admission (at least once)					< 0.05
Ever admitted	15	11.0	2	5.0	
Never admitted	77	80.9	47	43.0	
Use of prophylactic medication(s)					< 0.0001
Ever use	18	34.6	34	65.4	
Never use	74	83.1	15	16.9	
Period of absenteeism (days)[a]	15.3 ± 3.6		9.4 ± 2.9		< 0.0001

s = *standard deviation.*
[a]*Mean ± standard deviation.*

Table 3 **Multiple linear regression coefficients and equation for TNHEV during the current academic year in schoolboys with questionnaire-diagnosed asthma**

Independent variable	Coefficient value	Standard error (B)	95% CI	*P*-value
Constant	6.40	1.52	3.42, 9.38	0.01
Age	–0.21	0.01	–0.22, –0.18	0.0001
Presence of a smoker in family	0.8	0.02	0.76, 0.80	0.0001
Socioeconomic class	–1.43	0.32	–2.06, –0.80	0.001
Use of prophylactic medication(s)	–0.4	0.07	0.26, 0.54	0.0001
Admission to hospital	0.70	0.03	0.64, 0.76	0.0001

Equation: TNHEV = 6.40 – 0.21(age) + 0.80 (presence of a smoker in family – 1.43 (socioeconomic class) – 0.4 (use of prophylactic medication(s)) + 0.70 (admission to hospital).
R^2 = 0.52, P-value < 0.0001.
TNHEV = total number of hospital emergency room visits.
CI = confidence interval.

Association between HHEV and schoolboys' characteristics

The highest proportion of QDA was 34.8% (49/141) was for schoolboys aged between 12 and 15 years (Table 1); however, the proportion of HHEV was higher for younger age groups ($P < 0.0001$) QDAs (Table 2). Similarly, positive HHEV was found to be associated significantly and positively with the QDAs' histories of pets at home and with a smoking father or a family member. Positive HHEV was also found to be associated positively with QDAs who had ever been admitted to hospital due to bronchial asthma. However, significantly negative associations were found between HHEV and QDAs who had ever used prophylactic medication(s) and with increasing socioeconomic level with higher proportions among non-QDAs.

QDAs from the lower socioeconomic class (26%) had ever used prophylactic medication(s) significantly less than QDAs from collectively upper and middle socioeconomic classes (44%) ($\chi^2 = 4.6$, $P < 0.025$). However, QDAs from the lower socioeconomic class who were found to have ever visited the hospital emergency room and who were ever admitted to hospital due to bronchial asthma (81% and 21%) were significantly more than QDAs from collectively upper and middle socioeconomic classes (55% and 6%) ($\chi^2 = 10.1$ and 7.3 with $P < 0.005$ and $P < 0.01$ respectively).

Multiple linear regression for TNHEV during the current academic year

Table 3 shows the multiple linear regression coefficients and equation for the TNHEV during the current academic year. The histories of presence of a smoking family member and having ever admitted to the hospital were found to correlate positively with TNHEV, while age, socioeconomic class of the family and the history of having ever used prophylactic medications cor-

related negatively with TNHEV. The variability in these factors could explain up to 52% of the variation in TNHEV during the current academic year.

Discussion

Responses

The response rate of 95.6% in this study is an encouraging observation. This was probably due to the ease of the method (non-invasive) and to the cooperation of school-teachers and families. This supports previously reported successes using self-administered questionnaires in the field of bronchial asthma [*8,11,13,14,21*].

Comparing QDAs and non-QDAs

Supporting similar findings from previous studies [*22–24*], in this study, MPSA among asthmatic boys was found to be significantly more than the same among non-asthmatic boys. MPSA among QDAs was also found to be higher than the same reported in other similar studies [*25–27*]. Similar to earlier findings reported, in this study there was no significant difference in socioeconomic class and age between QDAs and non-QDAs, excluding the variation of these factors as possible causes for the difference [*23*]. Regarding socioeconomic class, our finding is consistent with earlier similar studies from Saudi Arabia [*14,15*], Arab [*28*] and other countries [*29–32*] suggesting no association with bronchial asthma, in general. On the other hand, our finding supports previous studies which documented that severe asthma is most prevalent in the lower socioeconomic class [*31,32*] and that ignorance of the distinction between grades of asthma severity may have resulted in conflicting results between studies in relation to the association with socioeconomic class [*31,32*].

Prevalence rate of positive HHEV and its associates

The rates of those with positive HHEV (65.2%) and those, who ever admitted to hospitals (12.0%) in this study, were higher than the same reported by other investigators [*33–35*]. This study supports earlier findings suggesting decline of positive HHEV among asthmatic children as they grow older [*2*]. Our results are consistent with the findings of others that showed positive HHEV (as an indicator of severity due to bronchial asthma) to be significantly associated with low socioeconomic class [*1,36–40*], hospital admissions [*33–35*], non-or under-use of prophylactic medication(s) [*2,38,41–45*], parental or a family member smoking [*2,36,38,45*], and presence of pets at home [*45,46*].

Increasing visits to hospital emergency room, school absenteeism and hospital admissions are well recognized circumstances reflecting the degree of severity of bronchial asthma [*33–35*]. Similar to findings that were reported earlier [*34*], asthmatic children in this study belonging to families from lower and to a lesser extent middle socioeconomic classes were at higher risk of suffering such impacts. These findings should be taken into consideration when designing and providing health care to this particular group of asthmatics. Compared with similar earlier work [*25*], the rate of history of those who had ever used prophylactic medication(s) in this study was comparatively low, indicating a high rate of under prophylaxis. Reports have shown that school absenteeism can fall 10-fold [*47*] and that overall disability because of asthma can fall by about 50% [*48*] after the initiation of prophylactic medications. Although physicians in Saudi Arabia tend to diagnose asthma early and readily [*8,13,14*], this study

shows that undertreatment is a problem that needs to be solved.

Multiple linear regression model for TNHEV

As a response variable, TNHEV had a reasonable multiple correlation with the explanatory variables. The goodness of fit represented by the multiple regression coefficient was acceptable for similar studies, explaining reasonably the variability in TNHEV. Similar associations between the response variable and some of the explanatory variables have been documented by other investigators [*12,33–45*]. The association between these explanatory variables and TNHEV can establish the basis in any screening programme in the future for severity of bronchial asthma among schoolchildren.

Conclusion

This study can be considered a baseline for further, broader studies in the same area, including wider age groups and female children. Based on the results of this study, authorities in the Saudi Ministry of Health and school health department may consider taking more steps towards addressing the reasons beyond the current situation. Physicians and schoolteachers may consider making use of emergency visits, hospital admissions and school absenteeism records as indicators of the severity of bronchial asthma among schoolchildren in Al-Khobar city. Asthmatic schoolchildren with increased frequency of hospital emergency visits may better be screened for possible associated factors. These include younger age groups, histories of presence of a smoking family member at home, reduced or no prophylactic medications being used, admission to hospital, and children belonging to a family from the lower socioeconomic class. Modifying the preventable factors is expected to minimize the severity and the disability, including TNHEV, associated with this disease.

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WHO Strategy for the Prevention and Control of Chronic Respiratory Diseases

Based on the Global Strategy for the Prevention and Control of Noncommunicable Diseases, the objectives of the WHO strategy on chronic respiratory diseases are:

- *Better surveillance* to map the magnitude of chronic respiratory diseases and analyse their determinants with particular reference to poor and disadvantaged populations, and to monitor future trends.
- *Primary prevention* to reduce the level of exposure of individuals and populations to common risk factors, particularly tobacco, poor nutrition, frequent lower respiratory infections during childhood, and environmental air pollution (indoor, outdoor and occupational).
- *Secondary and tertiary prevention* to strengthen health care for people with chronic respiratory diseases by identifying cost-effective interventions, upgrading standards and accessibility of care at different levels of the health care system.

This document can be accessed free online at: http://whqlibdoc.who.int/hq/2002/WHO_MNC_CRA_02.1.pdf