

PATTERN AND RISK FACTORS ASSOCIATED WITH HOSPITAL EMERGENCY VISITS AMONG SCHOOLBOYS WITH BRONCHIAL ASTHMA IN AL-KHOBAR

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Background: The objective of this cross-sectional study was to determine the prevalence of a history of hospital emergency visits (HHEV) among asthmatic Saudi schoolboys in the city of Al-Khobar and factors associated with such visits.

Subjects and Methods: The methodology included the distribution of a self-administered questionnaire, which was completed by the parents of 1482 schoolboys who satisfied the selection criteria of the study.

Results: The prevalence rate of questionnaire-diagnosed asthma (QDA) was 9.5%. The prevalence rate of a positive HHEV among QDA boys (QDAs) was 65.0%. Positive HHEV among QDAs was associated significantly with those who were younger ($P<0.0001$), with decreasing levels of socioeconomic class ($P<0.0001$), histories of pets at home ($P<0.0001$), presence of a currently smoking family member ($P<0.0001$), and/or a smoking father ($P<0.0001$), with mean period of school absenteeism ($P<0.0001$), and previous admission to hospital ($P<0.05$). It was also significantly associated with concomitant use of prophylactic medication(s) ($P<0.0001$). The multiple linear regression equation for the total number of hospital emergency visits during the current academic year was generated.

Conclusion: Asthmatic school children have a relatively higher rate of HHEV compared to the normal population. Modifying the preventable factors associated with the total number of hospital emergency visits is expected to decrease the severity and the disability associated with this disease.

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Key Words: Childhood asthma, emergency visit.

Childhood bronchial asthma is a chronic disease with an increasing prevalence, as well as a number of preventable hospital emergency visits and admissions.^{1,2} In the US, it was found that the annual direct cost to health care providers of only 1205 asthmatic patients was \$2.5 million.³ 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 was 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 was also found to be associated with future unemployment, maladaptive behavior, wasted opportunities and welfare costs.⁷ An increased number of hospital emergency visits may signal such a problem as poor management of a chronic illness such as bronchial

asthma. As a tool, the frequency and pattern of hospital emergency visits may be used as indicators of possible childhood and/or family health problems.²

In Saudi Arabia, a number of studies have been conducted to investigate certain aspects of bronchial asthma, including its prevalence among children.⁸⁻¹⁵ Reports from the Eastern Province estimate the prevalence of bronchial asthma among school children to be up to 10%^{8,9} and there is enough evidence to suggest that the rate is increasing.¹⁰ Consequently, morbidity and mortality of bronchial asthma continue to increase.^{11,12}

Environmental factors were found to be associated with the etiology of bronchial asthma among school children in the Eastern Province.^{8,9,13} The prevalence of bronchial asthma among Saudi school children was found to be higher in industrial, agricultural and urban areas as compared to desert and rural areas.^{8,14,15} To the best of our knowledge, no study has been conducted to determine the prevalence of hospital emergency visits among asthmatic children as an indicator of disability among school children in the city of Al-Khobar. Such a study is necessary to determine the nature and prevalence of disability due to childhood asthma. Factors associated with the frequency of emergency visits will also be determined. These are expected to help in better design and provision of

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appropriate services for the concerned children and their families.

Subjects and Methods

Saudi schoolboys in elementary and preparatory schools in Al-Khobar were the subjects of this cross-sectional study, which was conducted in the second term of the 1995 academic year. The city of Al-Khobar is located on the Arabian Gulf coast in the Eastern Saudi Arabia. A total of 22,077 schoolboys were identified from elementary (15,829, 71.7%) and preparatory (6248, 28.3%) schools in the city. A sample size of 1550 (7% of total) was taken, based on the usual equation of sample estimation.¹⁶ In that equation, 7% was used as the estimated proportion of bronchial asthma among school children in the study area, based on an earlier study in the region.¹¹ The determined total sample of 1550 schoolboys (elementary = 1110, 71.6% and preparatory = 440, 28.4%) was drawn from all the schools through simple random sampling (4 elementary + 2 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 the schools. The non-inclusion of schoolgirls in this study was due to difficulties in gaining access to them, a limitation that had also been faced by previous investigators.¹⁴

The methods used included a self-administered pre-tested and pre-coded questionnaire directed to parents. This questionnaire had previously been standardized, validated and applied to the Saudi community.^{8,13,14} The questionnaire 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 Medical Research Council (MRC) definition.¹⁸ 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 provide personal data such as age, area of residence, father's education, occupation and income. Data included 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 study period. The survey inquired about the history of presence of family pet(s) at home (bird, cat, etc). History of presence of at least one pet at home, any time during the study period, was considered a positive history. Data collected also included information on medications which had been used, or were being used by the child during the study period, the duration of use and method of administration.

The survey also inquired about the use of prophylactic medications. "Ever used" prophylactic medication(s) was

defined as the positive history of using at least one prophylactic medication during the study period. Absence of such history was considered as "never used." Histories pertaining to frequencies and reasons of school absenteeism, hospital admissions, emergency room visits were also collected. HHEV was considered positive when at least one hospital emergency visit was recorded during the study period. TNHEV was defined as the actual frequency (number) of visits to the hospital emergency room per case during the study period. "Ever admitted" was defined as at least one hospital admission due to bronchial asthma during the study period. "Never visited emergency" and "never admitted" to hospital were defined as absence of such specific histories during the study period. Total period of school absenteeism (TPSA) was defined as the actual period (in days) of school absenteeism per schoolboy during the study period. The mean period of school absenteeism was calculated as the average period (in days) of school absenteeism in each group.

The statistical program SPSS/PC +(20) was used to calculate the chi-squared differences and to assess the statistical significance of contingency tables. Z-test was used to test the differences between the two means. Multiple linear regression was used to analyze the data. TNHEV during the study period was the dependent variable. The independent variables were the age of the child (in years), socioeconomic class, histories of presence of pet at home, presence of a family member at home who is a smoker, and presence of a smoking father at home. They also included history of admission to hospital due to bronchial asthma and the history of use of prophylactic medication(s). The stepwise method was used to determine the final multiple regression model. A test was considered statistically significant at a *P*-value of <0.05.

Results

Of the 1550 schoolboys who were included in this study, 1482 completed the questionnaires, giving a response rate of 95.6%. Twenty-one schoolboys (1.4%) were excluded from the study because they were not living in Al-Khobar. The remaining 47 students (3.0%) declined to participate for reasons not related to the study. The cumulative prevalence of questionnaire-administered asthmas (QDAs) in the total sample was 9.5% (141/1482). The ages of the boys ranged from 6-15 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) (*Z*-test = 0.54, *P*>0.58).

A total of 223 (15%) schoolboys were found to belong to the upper socioeconomic class families compared with 756 (51%) and 503 (34%) who belonged to the middle and lower socioeconomic classes, respectively. No statistically significant difference was found among QDAs and non-QDAs regarding their socioeconomic class (chi-square =

3.46, $P < 0.12$). The mean period of school absenteeism among QDAs was 13.6 ± 3.4 days compared to 3.7 ± 2.2 days among non-QDA's (Z -test = 33.8, $P < 0.0001$).

Table 1 shows the sample rate of having pets at home among QDAs to be 51%, while the rates of presence of a smoking family member and father were 61% and 54.0%, respectively. Only 37% of QDAs were found to have previously used prophylactic medication. There were a total of 170 hospital emergency visits in the sample during the study period. The rate of QDAs who had positive HHEV was 65% (92/141), and 51 (55.6%), 23 (25%), 13 (14%) and 5 (5.4%) schoolboys visited the hospital emergency room once, twice, thrice and four to nine times, respectively. The rate of those who had previously been admitted to hospital (at least once), due to bronchial asthma in this study was 12% (17/141). There was a statistically significant difference in the mean period of school absenteeism during the study period among those with positive HHEV (15.3 ± 3.6 days) and negative HHEV (9.4 ± 2.9 days) (Z -test = 10.6, $P < 0.0001$).

Association between HHEV and Factors in Schoolboys' Characteristics

Table 1 shows the association between HHEV and factors in schoolboys' characteristics. Although the highest prevalence of QDA (35.0%) was among schoolboys aged between 12-15 years, Table 1 shows positive HHEV to be associated significantly with younger QDAs. It was interesting to note that QDAs from the lower socioeconomic class (26%) were found to have used prophylactic medication(s) significantly less than QDAs from both upper and middle socioeconomic classes (44%), (chi-square = 4.6, $P < 0.025$). However, QDAs from the lower socioeconomic class who were found to have visited the hospital emergency room and who had had previous hospital admissions because of bronchial asthma (81% and 21%, respectively) were significantly more than QDAs from both upper and middle socioeconomic classes (55% and 6%, respectively) (chi-square = 10.1 and 7.3, and $P < 0.005$ and $P < 0.01$, respectively).

Multiple Linear Regression for TNHEV during the Study Period

Table 2 shows the multiple linear regression coefficients and equation for the total number of hospital emergency visits during the study period. The history of the presence of a smoking family member and having been previously admitted to the hospital were found to correlate positively with TNHEV, while age, socioeconomic class of the family, and the history of having used prophylactic medications correlated negatively with TNHEV. The variability in these factors could explain up to 52% of the variations in TNHEV during the study period.

TABLE 1. Comparison of HHEV and factors in QDAs' characteristics.

Variable	Hospital emergency visits		P-value
	Yes (%) (n=92)	No (%) (n=49)	
Age groups (years)			
6-9	42 (45.7)	5 (10.2)	
9-12	31 (33.7)	14 (28.6)	<0.0001
12-15	19 (20.6)	30 (61.2)	
Socio-economic class			
Upper	7 (7.6)	15 (30.6)	
Middle	39 (42.4)	23 (46.9)	<0.0001
Lower	46 (50.0)	11 (22.5)	
Pets at home			
Yes	58 (80.6)	14 (19.4)	<0.0001
No	34 (49.3)	35 (50.7)	
Smoking by father			
Yes	63 (82.9)	13 (17.1)	<0.0001
No	29 (44.6)	36 (55.4)	
Smoking by a family member			
Yes	67 (77.9)	19 (22.1)	<0.0001
No	25 (45.5)	30 (54.5)	
Hospital admission (at least once)			
Ever admitted	15 (11.0)	2 (5.9)	<0.05
Never admitted	77 (80.9)	47 (43.0)	
Use of prophylactic medication(s)			
Ever use	18 (34.6)	34 (65.4)	<0.0001
Never use	74 (83.1)	15 (16.9)	
MPSA (days) Mean \pm SD	15.3 \pm 3.6	9.4 \pm 2.9	<0.0001

TABLE 2. Multiple linear regression coefficients and equation for TNHEV during the current academic year in Al-Khobar QDAs.

Independent variable	Coefficient value	SE(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 smoking family member	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

SE=standard error; CI=confidence interval; TNHEV=6.40-0.21 (age)+0.80; presence of a smoking family member=-1.43; socioeconomic class=-0.4; use of prophylactic medications + 0.70 (admission to hospital); $R^2=0.52$; P -value<0.0001.

Discussion

The response rate of 95.6% in this study was an encouraging observation. This was probably due to the ease of the method (noninvasive) and to the cooperation of schoolteachers and families. This supports previously reported successes using self-administered questionnaires in the field of bronchial asthma.^{8,11,13,14,21,22}

Prevalence Rate of Positive HHEV and its Associates

The rates of those with positive HHEV (65.2%) and those previously admitted to hospitals (12%) in this study

were higher than similar studies reported by other investigators.²³ This study supports earlier findings suggesting the 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 the severity of bronchial asthma) to be significantly associated with low socioeconomic status,^{1,24} hospital admissions,²³ non- or underuse of prophylactic medication(s),^{2,25} parental or a family member smoking,^{2,24} and presence of pets at home.²⁶

Increasing visits to hospital emergency room, school absenteeism and hospital admissions are well-recognized outcomes reflecting the degree of severity of bronchial asthma.²³ Similar to earlier reported findings, asthmatic children from lower and, to a lesser extent, middle socioeconomic classes in our study were at a higher risk of experiencing such outcomes. These findings should be taken into consideration when designing and providing health care to this particular group of asthmatics. Compared with similar earlier studies,²² the rate of those who had previously used prophylactic medication(s) was comparatively low in this study, indicating a high rate of undertreatment. Reports have shown that school absenteeism is reduced by 10-fold,²⁷ and that overall disability because of asthma falls by about 50%²⁸ after the initiation of prophylactic medications. Though physicians in Saudi Arabia have been shown to diagnose asthma early and more readily,^{8,13,14} this study proves that undertreatment is a problem that needs to be resolved.

The Multiple Linear Regression Model for TNHEV.

As a response variable, TNHEV had a reasonable multiple correlation with the explanatory variables. Similar associations between the response variable and some of the explanatory variables were documented earlier by other investigators.^{1,2,23-25} The association between these explanatory variables and TNHEV can establish the basis in any screening program in the future for severity of bronchial asthma among school children.

This study may be considered a baseline for further broader studies in future, including wider age groups and female children. Based on the results of this study, authorities in the Ministry of Health and School Health in particular, may consider taking more steps towards addressing the reasons for 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 schoolboys in Al-Khobar. Asthmatic schoolboys with increased frequency of hospital emergency visits should be screened for possible associated factors. These include the younger age group, those with smoking family members, those with reduced use of prophylactic medications or none at all, those with previous admissions to hospital, and children belonging to families from the lower socioeconomic class. Modifying the preventable factors is

expected to minimize the severity and the associated disabilities of this disease.

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