Schoolboys with Bronchial Asthma in Al-Khobar City, Saudi Arabia: Are They at Increased Risk of School Absenteeism?

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ABSTRACT

The objective of this cross-sectional study was to determine the mean period of school absenteeism (MPSA) among asthmatic Saudi schoolboys of Al-Khobar City and to determine the factors associated with the absenteeism. 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. The prevalence rate of questionnaire-diagnosed asthma (QDA) was 9.5% (141/1482). The MPSA among questionnaire-diagnosed asthmatic boys (QDAs) was 13.6 ± 3.4 days compared to 3.7 ± 2.2 days among non questionnaire-diagnosed asthmatic boys (non QDAs). Among QDAs, the MPSA was associated significantly and positively with those who were younger, and with decreasing levels of socioeconomic class, histories of pets at home, presence of a currently smoking family member (father or both parents), visit to a hospital emergency room, and admission to hospital. It was significantly and negatively associated with concomitant use of prophylactic medication(s), including those used appropriately. The QDAs from middle and lower socioeconomic classes showed less use of prophylactic medication(s) but more histories of visits to an emergency room and of admissions to hospital. The multiple linear regression equation for the total period of school absenteeism (TPSA) during the 1995 academic year was generated.

Asthmatic school children have a higher MPSA compared to their non asthmatic classmates. The risk of suffering the impacts of this disease is shown to be particularly increased among QDAs belonging to less socioeconomically advantaged families.

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INTRODUCTION

Bronchial asthma during childhood is considered to have been the single most prevalent cause of childhood disability during the past 25 years (1975–2000) [1]. Children who are frequently absent from school tend to perform poorly and are more likely to drop out before graduation from high school [2]. High levels of school absenteeism among children was shown to correlate with a poor teachers’ assessment of their social, psychological, and educational adjustment [3]. Excessive school absenteeism was also found to be associated with future unemployment, maladaptive behavior, wasted opportunities, and high welfare costs [2]. Persistent school absenteeism may signal such health problems as poor ability to cope with, or manage, chronic illnesses such as bronchial asthma. In addition to emergency room visits and hospitalizations, school absenteeism was considered to be a valid morbidity marker for asthma [3]. As a tool, school absenteeism patterns appear to be readily available and easy to use as indicators of childhood and/or family dysfunction that may turn out to be due to unfulfilled health needs [4].

Reports from eastern Saudi Arabia estimated prevalence of bronchial asthma among schoolchildren to be up to 10% [5,6] and there is enough evidence to suggest that prevalence of this disease is increasing [7]. Consequently, rates of morbidity and mortality due to bronchial asthma continue to increase [8,9]. In eastern Saudi Arabia, environmental factors were found to be associated with the etiology of bronchial asthma among schoolchildren [5,6,10]. 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 [5,11,12].

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 [5–12]. However, to the best of the investigator’s knowledge, no study has been conducted to measure the school absenteeism among asthmatic children as an indicator of disability among schoolchildren in Al-Khobar City.

Such a study is essential to provide a profile of some of the impacts related to the severity and disability of childhood asthma. Factors associated with the period of school absenteeism will also be determined. This is expected to help improve the design and provision of appropriate services to those children and their families. The objective of this study was to determine the mean period of school absenteeism (MPSA) among asthmatic Saudi schoolboys in Al-Khobar City, and to compare it with that of their nonasthmatic classmates during the 1995 academic year. Another objective was to determine the factors associated with the total period of school absenteeism (TPSA) during the same period.

POPULATION AND METHODS

The Saudi boys in elementary and preparatory schools in Al-Khobar City were the subjects of this cross-sectional study, which was conducted toward the end of the second term of the 1995 academic year. Al-Khobar City is located on the Arabian Gulf coast in the eastern part of the Kingdom 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) were calculated to be our sample. The sample size determination was based on the usual equation of sample estimation [13]. In that equation, 7% was used as the estimated proportion of bronchial asthma among school children in the region [8]. 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 (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 schools (in each level of education). In each school, the sample was drawn evenly and
randomly from different academic classes. The noninclusion of schoolgirls in this study was due to difficulties in gaining access, a limitation that had also previously faced some other investigators[11].

The methods used included a self-administered pretested and precoded questionnaire directed to parents. This questionnaire was previously standardized, validated, and applied to the Saudi community[5,10,11]. 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[14], which indicated a reliability of 95%.

The definition of asthma used in this study was modified from the Medical Research Council (MRC) definition[15]. 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 subject was considered to be 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 in 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[16].

The boys and their parents were requested to give details of 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 the presence of a smoker in the family during any period of the current academic year. The survey inquired about the presence of smoking by any household member and, more specifically, a parental smoking habit. Data collected also included information about the medications that had been used, or that 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 the use of prophylactic medications for asthma by the QDAs. “Ever use” prophylactic medication(s) was (were) 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.” If such medications were being/had been used, they were further classified as either (a) appropriate, or (b) inappropriate (based on the dosage, frequency, and method of administration). Histories pertaining to frequencies and reasons of school absenteeism, hospital admissions, and emergency room visits during the current academic year were also collected. “Ever visited hospital emergency room” was defined as at least one hospital emergency visit and “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. School records were checked for the exact TPSA during the current academic year.

The statistical program SPSS/PC[17] was used to calculate chi-square differences and to assess the statistical significance of contingency tables. Z-test was used to test the differences between the two means and the F-test of the analysis of variance (ANOVA) was used to test for the significance of the difference between more than two means. Multiple linear regression was used to analyze the data. The TPSA during the current academic year was the dependent variable. The independent variables consisted of age of the child (in years), socioeconomic class (coded as lower¼1, middle¼2, upper¼3), histories of presence of a pet at home (coded as no¼1, yes¼2), presence of a family member at home who is a smoker (coded as no¼1, yes¼2), presence of a smoking father at home (coded as no¼1, yes¼2), or both parents who smoked (coded as no¼1, yes¼2). They also included histories of visits to the hospital emergency room (coded as never¼1, ever¼2) and admissions to hospital (coded as never¼1, ever¼2), both due to bronchial asthma; and the history of use of prophylactic medication(s) (coded as never¼1, ever¼2). The stepwise method was used to determine the final multiple regression model. A test was considered statistically significant at p-value <0.05.
RESULTS

1. 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 were not living in Al-Khobar City. The remaining 47 students (3.0%) declined to participate for reasons not related to the study.

The cumulative prevalence of QDAs in the total sample was 9.5% (141/1482). The age range of the boys was 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 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, chi-square = 3.46, p > 0.12 (Table 1).

There was a statistically significant difference in MPSA during the current academic year among QDAs (13.6 ± 3.4 days) and non QDAs (3.7 ± 2.2 days), Z-test = 33.8, p < 0.0001 (Table 1).

Table 2 shows that sample rate of having pets at home among QDAs to be 51% while the rates of presence of a smoking family member, father, and both parents were 61%, 54%, 8%, respectively. It was interesting to find that all smoking mothers were married to smoking husbands (fathers of QDAs). The rate of QDAs who ever visited the emergency room was 65% and it was 12% for those who were ever admitted to hospital due to bronchial asthma. Only 37% of QDAs were found to have ever used prophylactic medication(s), and 71% of these users did not use them appropriately.

2. Association Between MPSA and Factors in Schoolboys’ Characteristics

The highest prevalence of QDA was 35% (49/141), which was among schoolboys aged 12–15 years (Table 1); however, the MPSA was found to be associated significantly and positively with younger QDAs (Table 2). Similarly, MPSA was found to be associated significantly and positively with the QDAs’ decreasing socioeconomic level, pets at home, and with a smoking family member, father, or both parents. The MPSA was also found to be associated positively with QDA boys who had ever visited the emergency room or who had ever been admitted to hospital due to bronchial asthma. However, significantly negative associations were found between MPSA and QDAs who had ever used prophylactic medication(s) and among those who used them appropriately.

The QDAs from the lower socioeconomic class (26%) were found to have ever used prophylactic medication(s) significantly less than QDAs from collectively 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 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-square = 10.1 and 7.3 with p < 0.005 and p < 0.01, respectively.

3. Multiple Linear Regression for TPSA During the 1995 Academic Year

Table 3 shows the multiple linear regression coefficients and equation for the TPSA during the
1995 academic year. The presence of a smoking family member, and the history of ever having visited the hospital emergency room were found to correlate positively with TPSA, while the socioeconomic class of the family and the history of ever having used prophylactic medications correlated negatively with TPSA. The variability in these four factors could explain up to 48% of the variation of TPSA during the 1995 academic year.

DISCUSSION

The response rate of 95.6% in this study is an encouraging observation. This was probably

| Table 2                                                                 |
|-------------------------------------------------------------------------|
| **Comparison of MPSA and Factors in Characteristics of QDAs**          |
| **Variable** | (n = 141) MPSA (Days) | S.D. (Days) | p-Value |
|--------------|-----------------------|-------------|---------|
| **Age groups (years)**                                                 |           |           |         |
| 6–9          | 47 (33)               | 13.2        | 2.4     |         |
| 9–12         | 45 (32)               | 11.5        | 2.1     | 0.001   |
| 12–15        | 49 (35)               | 8.6         | 2.2     |         |
| **Socioeconomic class**                                                |           |           |         |
| Upper        | 22 (15.6)             | 7.5         | 2.7     |         |
| Middle       | 62 (44.0)             | 9.3         | 2.3     | 0.001   |
| Lower        | 57 (40.4)             | 11.4        | 2.1     |         |
| **Pets at home**                                                       |           |           |         |
| Yes          | 72 (51.1)             | 12.6        | 1.6     | 0.0001  |
| No           | 69 (48.9)             | 5.3         | 1.4     |         |
| **Smoking by father**                                                  |           |           |         |
| Yes          | 76 (53.9)             | 13.4        | 2.4     | 0.0001  |
| No           | 65 (46.1)             | 7.3         | 3.1     |         |
| **Smoking by both mother and father**                                  |           |           |         |
| Yes          | 11 (7.8)              | 16.3        | 3.7     | 0.0001  |
| No           | 130 (92.2)            | 11.4        | 1.2     |         |
| **Smoking by a family member**                                         |           |           |         |
| Yes          | 86 (61.0)             | 14.3        | 2.4     | 0.0001  |
| No           | 55 (39.0)             | 6.1         | 2.7     |         |
| **Hospital emergency visit**                                           |           |           |         |
| Ever use     | 92 (65.2)             | 12.4        | 1.4     | 0.0001  |
| Never use    | 49 (34.8)             | 8.2         | 3.6     |         |
| **Hospital admission**                                                 |           |           |         |
| Ever use     | 17 (12.1)             | 12.4        | 3.6     | 0.0001  |
| Never use    | 124 (87.9)            | 6.2         | 1.4     |         |
| **Use of prophylactic medication(s)**                                  |           |           |         |
| Ever use     | 52 (36.9)             | 6.7         | 2.8     | 0.0001  |
| Never use    | 89 (63.1)             | 10.4        | 2.3     |         |
| ** Appropriateness of prophylactic medication** (n = 52)               |           |           |         |
| Appropriate  | 37 (71.2)             | 4.7         | 2.5     | 0.007   |
| Inappropriate| 15 (28.8)             | 7.3         | 3.4     |         |
due to the ease of the method (noninvasive) and the cooperation of schoolteachers and families. This supports previously reported successes using self-administered questionnaires in the field of bronchial asthma [5,8,10,11,18].

Supporting similar findings from previous studies [19–21], in this study MPSA among asthmatic boys was found to be significantly higher than the MPSA among nonasthmatic boys. Similar to earlier reported findings, in this study there was no significant difference in socioeconomic class between QDAs and non QDAs, excluding the variation of this factor as a possible cause for the difference [20]. While MPSA among QDAs was also found to be higher than that reported in other similar studies [22–24], this study supports earlier findings suggesting a decrease in the period of school absenteeism among asthmatic children as they grow older [20].

In this study, socioeconomic class was not found to be associated with presence or absence of QDA. In this regard, our finding is consistent with earlier similar studies from Saudi Arabia [11,12], Arab [25], and other countries [26–29].

Our results are consistent with the findings of other studies that showed period of absenteeism from school (as an indicator of severity due to bronchial asthma) to be significantly associated with low socioeconomic class [30], histories of hospital emergency visits [1], hospital admissions [1,30,31], non- or underuse of prophylactic medication(s) [22,32–37], parental or a family member smoking [38], and presence of pets at home [38].

The rates of those who ever visited hospital emergency rooms and were ever admitted to hospitals in this study were higher than those reported by other investigators [1,30,31]. The TPSA together with histories of hospital emergency visits and hospital admissions are well-recognized effects reflecting the degree of severity of bronchial asthma [1,3,31]. In this work, asthmatic children belonging to families from lower, and to a lesser extent middle, socioeconomic classes were at higher risk of suffering such effects. Similar findings were reported in earlier studies [30].

These findings should be taken into consideration when designing and providing health care to this particular group of asthmatics. Generally, it is well documented that severe asthma is most prevalent in the lower socioeconomic class [28,29] 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 [28,29].

Compared with similar earlier work [22], the rate of history of those who had ever used prophylactic medication(s) was comparatively low in this study, indicating a high rate of undertreatment. Reports have shown that school absenteeism was reduced 10-fold [37] and that overall disability because of

### Table 3

| Independent Variable                       | Coefficient Value | SE (B) | 95% CI          | p-Value |
|-------------------------------------------|-------------------|--------|-----------------|---------|
| Constant                                  | 11.54             | 2.86   | 5.93, 17.14     | 0.0001  |
| Presence of a smoking family member       | 6.03              | 2.83   | 0.48, 11.58     | 0.035   |
| Socioeconomic class                       | -1.63             | 0.68   | -3.0, -0.32     | 0.015   |
| Use of prophylactic medication(s)         | -1.7              | 0.45   | -2.58, -0.81    | 0.0002  |
| Visit to hospital Emergency room          | 1.98              | 0.17   | 1.65, 2.31      | 0.0001  |

Equation: $TPSA = 11.54 + 6.03 \times (\text{presence of a smoking family member}) - 1.63 \times (\text{socioeconomic class}) - 1.7 \times (\text{use of prophylactic medication(s)}) + 1.98 \times (\text{visit to hospital emergency room})$.

$R^2 = 0.48, p-value < 0.00001; \ SE = \text{standard error; } B = \text{regression coefficient; CI = confidence interval}$. 

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Asthma had fallen by about 50%\(^\text{[34]}\) after the initiation of prophylactic medications. Though doctors in Saudi Arabia were shown to diagnose asthma early and more readily\(^\text{[5,10,11]}\), this study proves that undertreatment still seems to be a problem that needs to be solved.

The multiple linear regression model for TPSA (response variable) 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 TPSA. Similar associations between the response variable and some of the explanatory variables were documented earlier by other investigators\(^\text{[1,30,33,38]}\). The association between these explanatory variables and TPSA can establish the basis in any screening program for bronchial asthma among schoolchildren.

This study may be considered a baseline for further, broader studies in the same area in the future, including studies on wider age groups and female children. Based on the results of this study, authorities in the Ministry of Health and school health may consider taking more steps toward addressing the reasons beyond the current situation. Physicians and schoolteachers may consider making use of school absenteeism records as an indicator of the severity of bronchial asthma among schoolboys in Al-Khobar City. Asthmatic schoolboys with high school absenteeism should be screened for possible associated factors. These include histories of presence of a smoking family member at home, few or no prophylactic medications being used, visits to hospital emergency room, and a child belonging to the lower socioeconomic class. Modifying all or some of these factors is expected to decrease the severity and the disability associated with this disease and to reduce TPSA. More emphasis in this regard may be directed toward asthmatic children belonging to socioeconomically less advantaged families.

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