

Asthma control among adults in Saudi Arabia

Study of determinants

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ABSTRACT

الأهداف: تحديد مسببات الربو الغير معالج أو الغير متحكم به لدى المرضى المصابين به في المملكة العربية السعودية.

الطريقة: شملت هذه الدراسة مجموعة من المرضى البالغين المصابين بالربو والذين أتوا بمواعيد مسجلة مسبقاً إلى 3 عيادات للطب التنفسي، الرياض، المملكة العربية السعودية. ولقد تم جمع البيانات منهم عن طريق المقابلات الشخصية. فيما تم استخدام الانحدار اللوجستي المتعدد من أجل تحليل بيانات الدراسة.

النتائج: لقد وصلت نسبة مرضى الربو الغير متحكم به إلى 68.1% (177 من أصل 260). وكان كلا من التدخين اليومي، أو الدخل الأسري الشهري الأقل من 15.000 ريال سعودي مرتبطة بما يعادل 4.6 ضعفاً (95% CI=1.3-16.4)، و 3.4 ضعفاً (95% CI=1.8-6.6) زيادة في ترجيح الإصابة بالربو الغير معالج. بالإضافة إلى ذلك فلم يتم التحكم بالربو لدى المرضى من غير الحاملين شهادات تخرج تعليمية (OR=3.1; 95% CI=1.0-9.5). والعاطلين عن العمل، والمعوقين، وكذلك غير القادرين على العمل (OR=3.1; 95% CI=1.4-6.9). كما وقلل حدوث الحموضة المعدية خلال الأسابيع الأربعة الماضية من أرجحية التحكم بالمرض بمعدل 2.5 (95% CI=1.3-4.9). كما وقلل حدوث التهاب الجيوب الأنفية المزمن خلال الأربعة أسابيع الماضية من أرجحية التحكم بالمرض لدى المصابين بمعدل 2.0 ضعفاً (95% CI=1.0-4.0). وعلاوة على ذلك فقد كان الإنثاء (OR=2.0; 95% CI=1.0-4.0). أو الأعمار الأكثر من أو تساوي 35 عاماً (OR=2.0; 95% CI=1.0-3.9) مرتبطة أيضاً بعدم التحكم بالمرض لدى المرضى المصابين بالربو.

الخلاصة: تشير النتائج الى أن أغلبية عينة الدراسة كانوا يعانون من الربو الغير متحكم به، وأن العوامل الاجتماعية والسكانية التي لا يمكن تعديلها بسهولة (الدخل الأسري، والتعليم، والمهنة، والجنس، والعمر) قد تزيد من نسبة الربو غير المتحكم به. وعلى العكس فإن عوامل الخطر التي يمكن تعديلها مثل التدخين والعوامل السريرية كحرقة المعدة والجيوب الأنفية المزمنة يمكن استهدافها للتحكم بالربو عند المرضى الذين يعانون منه.

Objectives: To explore the determinants of uncontrolled asthma in Saudi Arabia.

Methods: A consecutive series of adult asthma patients attending 3 pulmonary primary care clinics in Riyadh, Saudi Arabia for a scheduled appointment

were interviewed. A multiple logistic regression analysis was used.

Results: The proportion of patients with uncontrolled asthma was 68.1% (177/260). Daily tobacco smoking or monthly household income less than 15,000 Saudi Arabian Riyals were associated with a 4.6 (95% confidence interval [CI]=1.3-16.4) and 3.4 (95% CI=1.8-6.6) times increase in the odds of having uncontrolled asthma. Patients with less than a graduate degree (odds ratio [OR]=3.1; 95% CI=1.0-9.5) or patients who were unemployed, disabled, or too ill to work (OR=3.1; 95% CI=1.4-6.9) had poorer asthma control. Having heartburn during the past 4 weeks decreased the odds of asthma control by 2.5 (95% CI=1.3-4.9), and having chronic sinusitis during the past 4 weeks decreased the odds of asthma control by 2.0 (95% CI=1.0-4.0) times. Being female (OR=2.0; 95% CI=1.0-4.0) or ≥ 35 years of age (OR=2.0; 95% CI=1.0-3.9) was also associated with having uncontrolled asthma.

Conclusion: Our findings suggest that most respondents had uncontrolled asthma. Less modifiable socio-demographic factors (for example, income, education, occupation, gender, and age) significantly increased the odds of having uncontrolled asthma. However, modifiable risk factors such as tobacco smoking and clinical factors such as heartburn and chronic sinusitis could also be targeted for intervention.

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Asthma is a chronic disease that is caused by airway inflammation and obstruction. The prevalence of asthma is approximately 300 million worldwide and continues to increase. Common asthma symptoms include coughing, wheezing, chest tightness, and shortness of breath. These symptoms range from mild to severe and can lead to a fatal outcome. Symptoms of uncontrolled asthma can appear several times a day and can considerably decrease the quality of life of asthma patients and their family members. The economic burden of asthma is substantial and includes medical and non-medical costs.¹⁻⁴ Currently, the main goal of asthma treatment is to control the disease and minimize the number of episodes of exacerbation. Asthma can be effectively controlled in most patients by avoiding common triggers and by adhering to prescribed treatment regimens.⁵ However, even in developed countries, 40-70% of patients have inadequately controlled asthma.^{6,7} The proportion of patients with uncontrolled asthma is also high in Kingdom of Saudi Arabia (KSA), with reports as high as 64% in adults,⁸ and 59.3% in children.⁹ Factors affecting asthma control include socio-demographic characteristics, psychosocial factors, asthma severity, adherence to treatment, an appropriate inhaler technique, and exposure to infectious agents (especially viruses), and to indoor and outdoor allergens or pollutants.^{1,10-14} The presence of comorbidities (for example, hypertension, chronic sinusitis, and gastroesophageal reflux disease) also contribute to an increased risk of poor asthma control.^{11,15-17} Uncontrolled asthma is an important public health problem in KSA, but only a very limited number of studies have been conducted to explore this issue. The objectives of the current study were to determine the proportion and determinants of uncontrolled asthma in adults who presented at 3 pulmonary primary care clinics Riyadh, KSA.

Methods. Study design. The study design was a cross-sectional survey of asthma patients.

Target population. A consecutive series of adults asthma patients (≥ 18 years of age) who attended the pulmonary primary care clinic of King Khalid University Hospital, King Fahad Medical City, and the Advanced Medicine Center in Riyadh, Kingdom of Saudi Arabia during the study period from February to March 2014

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for a scheduled appointment were approached by clinic staff nurses and were referred to the interviewer. Patients who had been diagnosed by a physician at least 3 months before joining the study, were not pregnant, and did not have respiratory diseases other than asthma were included in the study. Study participants signed the consent form and completed the questionnaire before being examined by the doctor. The Institutional Review Boards of King Fahad Medical City and the College of Medicine of King Saud University approved this study.

Instruments. A structured, self-administered questionnaire was used to assess the socio-demographic and clinical characteristics of the asthma patients. Asthma control was measured using an Arabic version of a valid and reliable asthma control test (ACT) designed to be used for individuals ≥ 12 years of age.^{18,19} The original questionnaire was developed and validated by Nathan and colleagues.¹⁸ The asthma control score ranged from 5 to 25. Higher scores indicated a higher level of asthma control. A patient's asthma was considered to be uncontrolled if the ACT score was ≤ 19 . The specificity of the questionnaire were 69.2%, and the sensitivity was 76.2%, compared with the specialist's rating. An internal consistency reliability was 0.84.¹⁸ A linguistic validation of the Arabic version of the ACT was conducted by the MAPI research institute (MAPI Institute, Lyon, France). The questionnaire was piloted among 25 patients by trained interviewers before it was used for the study.

Statistical analysis. Data entry and statistical analyses were performed using IBM SPSS Statistics for Windows, Version 21.0 (IBM Corp, Armonk, NY, USA). Descriptive statistics were used to characterize the overall sample. Pearson's Chi-square test, Fisher's exact test, linear-by-linear association test, or simple logistic regression analysis was used to evaluate associations between outcome and exposure variables. Statistically significant ($p < 0.05$) or near to significant variables were included in the multiple logistic regression model. Covariates included in the model were age, gender, education, occupation, marital status, monthly household income, body mass index (BMI), tobacco smoking, and comorbidities (for example, allergic rhinitis, chronic sinusitis, and heartburn). Only statistically significant variables ($p < 0.05$) were maintained in the final model. The Hosmer-Lemeshow test was used to assess the goodness-of-fit. All covariates were checked for co-linearity and assessed for interaction effects.

Results. Out of 304 eligible patients who were approached in the waiting area, 260 (85.5%) agreed to participate in the study. Almost one-half of the patients were female (48.8%). The median age of

the participants was 34 years (interquartile range [IQR]=25-45). Most of the respondents were married (64.2%) and had a bachelor's and/or graduate degree (57.3%). Table 1 presents a summary of the results for the socio-demographic characteristics of the study population. Uncontrolled asthma was present in 68.1% (177/260) of the patients. The median duration since the asthma diagnosis was 10.5 years (IQR=6.0-20.0). Many of the asthma patients reported having co-morbid conditions, such as allergic rhinitis (66.2%), chronic sinusitis (38.8%), obesity (38.1%), and hypertension (19.6%). The results for the clinical characteristics for all respondents are presented in Table 2.

The results of a bivariate analysis revealed that age, gender, marital status, education, and occupation, monthly household income, obesity, chronic sinusitis or allergic rhinitis, and having heartburn during the past 4 weeks, were associated with having uncontrolled asthma (Table 3). In the multiple logistic regression analysis, the associations between asthma control and age, gender, education, occupation, and monthly household income, smoking, sinusitis and heartburn remained significant throughout the analysis

Table 1 - Socio-demographic characteristics of Saudi asthma patients.

Characteristics	(N = 260) n (%)
Age in years	
< 35	147 (56.5)
≥ 35	111 (42.7)
Gender	
Male	130 (50.0)
Female	127 (48.8)
Nationality	
Saudi Arabian	251 (96.5)
Other	7 (2.7)
Residence	
Riyadh	167 (64.2)
Other	91 (35.0)
Highest level of completed education	
None	19 (7.3)
Secondary (or less)	88 (33.8)
Bachelor	129 (49.6)
Graduate	20 (7.7)
Employment status	
Employed	106 (40.7)
Unemployed	88 (33.8)
Retired/student	61 (23.5)
Disabled or too ill to work	2 (0.8)
Marital status	
Single	72 (27.7)
Married	167 (64.2)
Divorced/widowed	18 (6.8)
Persons per bedroom, median (IQR)	1.5 (1.0 - 2.0)
Monthly household income in SAR	
4,999 or less	36 (13.8)
5,000 - 9,999	64 (24.6)
10,000 - 14,999	58 (22.3)
15,000 - 25,000	45 (17.3)
25,000 - 39,999	27 (10.4)
40,000 or more	5 (9.9)

IQR - interquartile range, SAR - Saudi Arabian riyals

($p < 0.05$). The results of the multiple logistic regression analysis are presented in Table 3. The Hosmer-Lemeshow goodness-of-fit test showed no evidence of lack of fit of the model ($\chi^2 (8) = 10.953, p = 0.204$). The final model included 242 (93.8%) cases.

Discussion. Key results. We found that most (68.1%) of the adult patients with physician-diagnosed asthma for at least 3 months, and who were attending a pulmonary primary care clinic for a scheduled appointment, had uncontrolled asthma. Asthma control level was significantly associated with patients' clinical (for example, having heartburn, or chronic sinusitis) and socio-demographic (for example, age, gender, education, occupation, and income) characteristics. Tobacco smoking also significantly increased the odds of having uncontrolled asthma.

Table 2 - Clinical and behavioral characteristics of Saudi asthma patients.

Characteristics	(N = 260) n (%)
Asthma control	
Controlled	83 (31.9)
Uncontrolled asthma	177 (68.1)
Asthma diagnosis in years, median (IQR)	10.5 (6.0 - 20.0)
Allergic rhinitis	
Yes	172 (66.2)
No	86 (33.1)
Chronic sinusitis	
Yes	101 (38.8)
No	154 (59.2)
Heartburn during the past 4 weeks	
None	76 (29.2)
A little of time	54 (20.8)
Some of the time	58 (22.3)
A good bit of the time	38 (14.6)
Most of the time	29 (11.2)
Hypertension	
Yes	51 (19.6)
No	207 (79.6)
BMI in kg/m²	
Underweight (< 18.50)	4 (1.5)
Normal range (18.50 - 24.99)	58 (22.3)
Overweight (25.00 - 29.99)	85 (32.7)
Obese class I (30.00 - 34.99)	48 (18.5)
Obese class II (35.00 - 39.99)	26 (10.0)
Obese class III (≥ 40.00)	25 (9.6)
Tobacco smoking	
Daily	22 (8.5)
Less than daily	14 (5.4)
Not at all	220 (84.6)
Tobacco smoking inside the house	
Yes	49 (18.8)
No	208 (80.0)
Sleeping with a tobacco smoker	
Yes	27 (10.4)
No	230 (88.5)
Tobacco smoker at office/workplace	
Yes	50 (19.2)
No	201 (77.3)

IQR - interquartile range, BMI - body mass index

Interpretation. The proportion of patients with uncontrolled asthma in our study population was 68.1%. A similar study performed in KSA in 2006⁸ reported that 64% of adults have uncontrolled asthma. Comparable results were reported for many developing and developed countries. The 2010 European National Health and Wellness Survey¹⁰ that was conducted in France, Germany, Italy, Spain, and the UK found that 53.5% of patients receiving treatment have asthma that is not well-controlled (range, 47.3% in Spain to 62.5% in Germany). The Asthma Control Characteristics and Prevalence Survey Study (ACCESS) conducted in 2008 revealed that 58% of US adult patients have uncontrolled asthma.¹¹ The 2011 Latin America²⁰ and Asia-Pacific Asthma Insights and Management surveys³ reported that 93% and 92.4% of the asthma occurring in these regions is partly controlled or uncontrolled. Our analysis revealed that patients who smoked tobacco daily had a 4.6 times higher odds (95% confidence interval [CI]=1.3-16.4) of having uncontrolled asthma compared with patients who did not smoke, or smoked less than daily. Tobacco smoke is one of the main triggers of asthma symptoms.¹ The results of numerous other studies have indicated that

there is a significant association between poor asthma control and smoking.^{10,15,21-23} We found that the odds of uncontrolled asthma in respondents with monthly household incomes <Saudi Arabian Riyal (SAR) 15,000 was 3.4 times higher (95% CI=1.8-6.6) than the odds of uncontrolled asthma in respondents with monthly household incomes ≥SAR 15,000. Different factors related to income, such as access to quality health services, and living in a healthy home and healthy environment, are associated with having well-controlled asthma.^{24,25} The associations between income and asthma control have been reported in a variety of articles.^{11,26} The threshold of SAR 15,000 seems to be important for KSA, because one of the previous studies found that there is a similar relationship between household income and asthma control in children.⁹

The results from this study suggest that education and occupation are among key factors associated with asthma control. There was a 3.1-fold increase in the odds of having uncontrolled asthma for patients with less than graduate degree (odds ratio [OR]=3.1; 95% CI=1.0-9.5) and for patients who were unemployed, disabled, or too ill to work (OR=3.1; 95% CI=1.4-6.9). Education level and occupation type are often reported to be associated

Table 3 - Determinants of asthma control among Saudi adults.

Factor	Uncontrolled n (%)	Controlled n (%)	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Marital status				
Divorced/Widowed	17 (94.4)	1 (5.6)	8.9 (1.2 - 68.3)	-
Single/Married	156 (65.5)	82 (34.5)	Reference	
Tobacco smoking				
Daily	17 (85.0)	3 (15.0)	2.8 (0.8 - 9.7)	4.6 (1.3 - 16.4)
Less than daily or not at all	156 (67.2)	76 (32.8)	Reference	
Monthly household income in SAR				
< 15 000	123 (77.8)	35 (22.2)	3.5 (2.0 - 6.1)	3.4 (1.8 - 6.6)
≥ 15 000	48 (50)	48 (50)	Reference	
Occupation				
Unemployed/disabled/too ill to work	76 (84.4)	14 (15.6)	3.9 (2.0 - 7.4)	3.1 (1.4 - 6.9)
Employed/retired/student	97 (58.4)	69 (41.6)	Reference	
Education				
Less than graduate	163 (69.4)	72 (30.6)	2.8 (1.1 - 7.0)	3.1 (1.0 - 9.5)
Graduate	9 (45.0)	11 (55.0)	Reference	
Heartburn during past 4 weeks				
A little of the time or more	133 (74.7)	45 (25.3)	2.7 (1.5 - 4.7)	2.5 (1.3 - 4.9)
None	40 (52.6)	36 (47.4)	Reference	
Gender				
Female	97 (77.0)	29 (23.0)	2.4 (1.4 - 4.1)	2.0 (1.0 - 4.0)
Male	76 (58.5)	54 (41.5)	Reference	
Chronic sinusitis				
Present	79 (79.0)	21 (21.0)	2.4 (1.3 - 4.3)	2.0 (1.0 - 4.0)
Not present	94 (61.0)	60 (39.0)	Reference	
Allergic rhinitis				
Present	123 (71.9)	48 (28.1)	1.8 (1.0 - 3.0)	-
Not present	51 (59.3)	35 (40.7)	Reference	
Age in years				
≥ 35	82 (74.5)	28 (25.5)	1.8 (1.0 - 3.0)	2.0 (1.0 - 3.9)
< 35	92 (62.6)	55 (37.4)	Reference	
Obesity				
Present	72 (72.7)	27 (27.3)	1.6 (0.9 - 2.8)	-
Not present	91 (62.3)	55 (37.7)	Reference	

SAR - Saudi Arabian riyals, CI - confidence interval

with asthma control. A recent study in Henan province of China²² found that patients with asthma and no college degree have a significantly greater risk of having partially controlled, or uncontrolled asthma compared with asthma patients with a college degree. The results of a cross-sectional multicenter survey in Turkey²⁷ indicated that education below a secondary school level is a predictor of inadequately controlled asthma. Similarly, 2 large-scale surveys conducted in different European countries found that there is a significant association between employment status and asthma control.^{11,21}

The results of our study indicated that comorbidities (for example chronic sinusitis and heartburn) are associated with asthma control. The presence of heartburn symptoms during the past 4 weeks was associated with a 2.5 times greater odds of having uncontrolled asthma (OR=2.5; 95% CI=1.3-4.9). Chronic sinusitis was associated with a 2.0 times increase in the odds of having uncontrolled asthma (OR=2.0; 95% CI=1.0-4.0). Heartburn is among the most common presentations of gastroesophageal reflux disease (GERD) and it causes or exacerbates a variety of respiratory tract diseases.²⁸ The role of GERD in asthma control is still under investigation, but several investigators have reported significant associations between these 2 conditions. For example, findings similar to our study have been reported from the Asthma Control Characteristics and Prevalence Survey Studies in the US.¹¹ In another study, ten Brinke and his colleagues²⁹ also reported that there is a significant association between GERD and asthma control.

Sinonasal comorbidities are often present in asthma patients. The results of recent studies suggest that a common pathophysiology is present, but the mechanism is under investigation.³⁰ The presence of chronic sinusitis is associated with more frequent exacerbations and poorer asthma control.³¹ A study conducted in Sweden found that chronic sinusitis significantly increases the risk of having an increased frequency of asthma symptoms.³² A recent literature review by Jang³³ concluded that proper management of chronic sinusitis can improve asthma symptoms. We did not find a statistically significant relationship between allergic rhinitis and asthma control after controlling for the presence of chronic sinusitis. Similar to our study, Dixon and his colleagues³¹ found that asthma exacerbation rates were similar among patients with and without allergic rhinitis when taking into consideration the existence of chronic sinusitis.

Depending on the culture, gender can affect health status and health outcomes by increasing exposure to health risk factors, and by limiting access to health care and to health information.³⁴ In KSA the proportion of female patients with uncontrolled asthma is almost

1.5 times greater compared with that of among male patients,⁸ and studies in Turkey,²⁷ Italy,³⁵ and in the US,¹² show that females have poorer asthma control than males. Our results are consistent with these findings as we found that females had approximately 2 times greater odds of having uncontrolled asthma (OR=2.0; 95% CI=1.0-4.0) compared with males.

In our study, respondents who were ≥ 35 years of age had a 2.0-fold greater odds of having uncontrolled asthma (OR=2.0; 95% CI=1.0-3.9) compared with younger respondents (<35 years). Similar to the results of our study, the 2010 European National Health and Wellness Survey revealed that compared with adults aged <35 years, the proportion of patients with uncontrolled asthma is significantly higher among adults aged ≥ 35 years.¹⁰ The findings from a report on asthma control and clinical management in children and adults in Michigan, USA, revealed an increased prevalence of asthma hospitalization, activity limitations, and frequency of asthma symptoms during the previous month among adults ≥ 35 years of age.³⁶

Limitations. The associations found in this cross-sectional study do not imply causality. Because this study was conducted in only 3 clinics in Riyadh, the generalizability of the findings may be limited. Further multicenter studies are required. A larger sample size may also strengthen the results of our study.

In conclusion, despite the availability of the contemporary Saudi Initiative for Asthma group treatment guidelines for the management of asthma,³⁷ the majority of respondents had uncontrolled asthma. Less modifiable socio-demographic factors (for example, income, education, occupation, gender, and age) significantly increased the odds of having uncontrolled asthma among adult asthma patients in KSA. However, modifiable risk factors such as tobacco smoking and clinical factors such as heartburn and chronic sinusitis could also be targeted for intervention and improvement in asthma control.

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