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QUALITY OF LIFE

Asthma quality of life in Saudi Arabia: Gender differences

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ABSTRACT

Objectives: To explore potential gender differences in the factors associated with asthma-specific quality of life (AQL). **Methods:** A cross-sectional study of consecutive series of adult patients attending primary care centers at three major hospitals in Riyadh, Saudi Arabia, was performed. AQL was measured using a standardized version of the AQL questionnaire (min = 1, max = 7), with higher scores indicating a better AQL. Multiple linear regression analysis was performed. **Results:** The mean AQL was 4.3 (standard deviation [SD] = 1.5) for males and 4.0 (SD = 1.3) for females ($p = 0.113$). With each unit increase in asthma control, the AQL improved by 0.19 points (95% confidence interval [CI] = 0.14–0.23) in men and by 0.21 points (95% CI = 0.16–0.25) in women. Daily tobacco smoking was associated with a 0.72 point (95% CI = 0.14–1.30) decrease in the AQL among males. Women who had a household member who smoked inside the house had a significantly lower AQL ($B = -0.59$, 95% CI = $-1.0 - -0.19$). A monthly household income of 25,000 Saudi Riyals or more was associated with a better AQL among men ($B = 0.51$, 95% CI = 0.01–1.01), whereas being employed exhibited a protective effect in women ($B = 0.48$, 95% CI = 0.11–0.84). Higher levels of perceived asthma severity were associated with better AQL in women ($B = 0.82$, 95% CI = 0.36–1.28). **Conclusions:** Our findings revealed gender-specific differences in the correlates of AQL in Saudi Arabia, particularly in tobacco exposure, socio-economic factors and perceived asthma severity.

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Introduction

Asthma is a serious public health problem, and its prevalence is increasing, posing a substantial impact on society and health care systems. Asthma symptoms include wheezing, shortness of breath, chest tightness, cough and airflow limitation; these symptoms can potentially advance to life threatening conditions. There are high economic costs associated with asthma, including medical costs, such as hospitalization and medication, and non-medical costs [1, 2]. In addition, asthma can restrict patient quality of life physically, emotionally and socially [3, 4].

Results from a national household survey conducted in Saudi Arabia in 2013 showed that the prevalence of asthma in adult Saudi population was approximately 4.1%, with no statistically significant difference between men and women. Among those who reported having asthma, 50.6% were not receiving medical treatment for asthma, and 61.6% sought an urgent asthma care from the emergency room or hospital during the past 12 months

[5], despite the free universal health care provided to all citizens, as well as expatriates working in the public sector. Also, it is compulsory for private companies to provide health insurance to its employees, both citizens and residents [6, 7].

Asthma is a chronic disease that currently has no cure. The main treatment goal is to control the condition by limiting the frequency of symptoms, maintaining normal activity levels, reducing the probability of exacerbations, and improving the quality of life [3].

Current advancements in the knowledge and availability of contemporary medicine can help clinicians effectively control asthma when patients adhere to their treatment plans.[8] However, even in developed countries, 40–70% of patients have uncontrolled asthma [9,10]. Similarly, recent studies have shown that the majority of asthma patients in Saudi Arabia have uncontrolled asthma, with significantly higher levels of uncontrolled asthma among women (77.0% vs. 58.5%) [11]. Another study in two emergency rooms of Riyadh revealed that

most of asthma patients (60.9%) seeking treatment were female [12].

Patient quality of life has been shown to moderately correlate with the clinical parameters of asthma, and it is considered to be a separate but important aspect of asthma health status. The National Heart, Lung and Blood Institute in the United States recommends periodically assessing the quality of life of asthma patients and that it be managed along with clinical symptoms [13].

Numerous studies of asthma patients have explored their quality of life, which has been shown to be associated with different sociodemographic characteristics, such as gender, education, occupation, income, clinical characteristics (e.g., asthma control and asthma severity), and environmental factors (e.g., exposure to tobacco smoke) [14–17]. However, few studies have provided gender-specific analyses of the quality of life of asthma patients. In addition, we were unable to identify any studies investigating the quality of life of asthma patients in Saudi Arabia.

Thus, in the present study, we aimed to investigate the asthma-specific quality of life (AQL) of adult patients with physician-diagnosed asthma who attended at primary care centers of three major hospitals in Riyadh, Saudi Arabia, for routinely scheduled follow-up visits; in addition, we also explored the potential gender differences in the factors associated with AQL in this patient cohort.

Methods

This cross-sectional study examined a consecutive series of adult patients (18 years of age and older) with physician-diagnosed asthma who attended primary care centers of King Khalid University Hospital, King Fahad Medical City and Advanced Medical City, in Riyadh, Saudi Arabia, for routinely scheduled follow-up visits from February to March, 2014. The diagnosis of asthma in our study population was based on medical history, physical examination and objective measurements, including spirometry and reversibility testing, recommended by the Saudi Initiative for Asthma guidelines for the diagnosis and management of asthma [18]. The following exclusion criteria were applied: an asthma diagnosis of less than 3 months, pregnancy, and the presence of respiratory diseases other than asthma. The Institutional Review Board of the College of Medicine, King Saud University and King Fahad Medical City approved this study, and all study participants provided written informed consent before completing the questionnaire. Patients were not paid or offered any incentive to participate in the study.

A structured, self-administered questionnaire was used to collect data. Patients were approached by nurses in the waiting area before their scheduled appointment and

were referred to our project staff. Six project staff were trained for the field work by an experienced researcher to standardize the procedures and provide their roles and responsibilities, as well as quality-control procedures. A field supervisor was available to coordinate the process. The questionnaire took approximately 10 minutes to complete. The survey was written at a language no higher than sixth- to eighth-grade level. None of our respondents was illiterate. A trained project staff was available to address participants' questions.

AQL was measured using a standardized version of the asthma quality of life questionnaire, which consisted of 4 domains (i.e., symptoms, activity limitation, emotional function and environmental stimuli), with 32 questions. The asthma quality of life score was derived by averaging the scores across the responses, with higher values indicating a higher quality of life (min. = 1; max. = 7). The questionnaire was validated by Juniper and her colleagues [19]. The cultural adaptation and linguistic validations were performed by the MAPI Research Institute (MAPI Institute, Lyon, Rhone-Alpes, France).

Asthma control was measured using an Arabic version of 5-item questionnaire, the asthma control test, which has been validated, demonstrating high levels of internal consistency reliability ($\alpha = 0.92$) and statistically significant correlation between asthma control test scores and specialist rating of asthma control ($r = 0.482$, $p = 0.002$) [20], with parameters similar to the initial English version of the questionnaire [21]. The asthma control test scores can range from 5 to 25, with higher scores indicating better asthma control. The MAPI Research Institute conducted the linguistic validation of the Arabic version.

Perceived asthma severity and daily stress during the past 4 weeks were measured using a visual analogue scale, where 0 corresponded to not severe or no stress and 10 to very severe or severe stress, respectively. Both variables were dichotomized at the scale midpoint (≤ 5 and >5). Body mass index was calculated from self-reported height and weight.

Statistical analyses were conducted using IBM SPSS Statistics for Windows, Version 21.0 (IBM Corp., Armonk, NY, USA). The statistician analyzed the data according to the study objectives. Three participants were excluded during the data cleaning process because of incomplete outcome data. Some of the participants had a few missing data, which were ignored during the analysis. We conducted descriptive analyses for each variable of interest. Student's *t*-test and an analysis of variance (ANOVA) were performed to examine the association between each independent variable and the mean AQL score. Simple linear regression analysis was used to quantify the relationship between asthma control and AQL. In bivariate testing, variables with a *p*-value of less than 0.10 (Table 3) were placed in a multiple linear

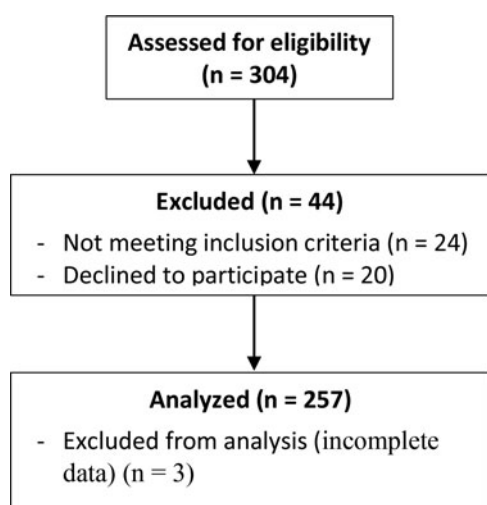


Figure 1. Flow of participants through the study.

regression model. Only statistically significant variables ($p < 0.05$) were maintained in the final model. All tests were 2-sided. The assumptions of linearity, independence of errors, homoscedasticity, and normality of residuals were met.

Results

Of the 304 participants approached, 280 (92.1%) were eligible and 260 (85.5%) agreed to participate in the study. Three participants were excluded during the data cleaning process because of incomplete outcome data (Figure 1). Table 1 shows the sociodemographic, clinical and (some) lifestyle-related patient characteristics collected in this study, according to gender. Residence, occupation, marital status, asthma control level, body mass index (BMI) and tobacco exposure differed between the males and females.

Table 2 provides the AQL scores from our study population. Overall, the mean AQL score was 4.2 (standard deviation [SD] = 1.4), with no statistically significant difference observed between males and females. In a domain-specific analysis, the symptoms domain score was 0.4 points lower for the women compared to the men with $p = 0.067$. No statistically significant difference between men and women was observed in the other domains.

In a univariate analysis, four factors among males and seven factors among females were associated with AQL (Table 3). The asthma control score, perceived asthma severity during the past 4 weeks and income were common for both males and females. Meanwhile, tobacco smoking was associated with AQL in men, and occupation and age, as well as having a household member who smoked tobacco inside the house were associated with AQL in women.

Tables 4 and 5 show the multivariate linear regression analysis results for men and women, respectively. A significant regression equation was found for both males ($F[3,118] = 30.9$, $p < 0.001$, adjusted $R^2 = 0.426$) and females ($F[4,119] = 29.3$, $p < 0.001$, adjusted $R^2 = 0.479$).

Among men, higher asthma control scores, not being a daily tobacco smoker, and a monthly household income of SAR 25,000 or greater were significantly ($p < 0.05$) associated with a better quality of life (Table 4).

Among women, higher asthma control scores and higher levels of perceived asthma severity during the past 4 weeks, as well as having no household members smoking inside the house and being employed were independently associated with higher AQL levels (Table 5).

Discussion

In this study, we investigated the level of asthma quality of life and performed a separate gender analysis of the factors associated with the asthma quality of life level among physician-diagnosed adult asthma patients attending primary care centers of three major hospitals in Riyadh, Saudi Arabia, for routinely scheduled follow-up visits.

In our study, the mean AQL level was 4.3 (SD = 1.5) for males and 4.0 (SD = 1.3) for females, out of a 7-point scale, and there were no statistically significant differences ($p = 0.113$). A study in Northern Portugal showed that the asthma-specific quality of life was higher compared to our population, averaging 6.2 for males and 5.3 for females [22]. In another study conducted in Colorado in the United States, the asthma-specific quality of life was 5.2 and 5.0 for males and females, respectively [16]. These results suggest that there might be substantial room for improvement in the AQL for the patients in Saudi Arabia.

Our results show that with each unit increase in asthma control, the AQL improved by 0.19 (95% CI = 0.14–0.23) points in men and 0.21 (95% CI = 0.16–0.25) points in women. As expected, our results confirmed the previous finding that AQL is associated with asthma control. De Souse and colleagues [23] found a strong correlation between asthma control and quality of life. Schatz et al reported a similar correlation level [16], however, no detailed analysis was performed to describe that association.

In the present study, we found that daily tobacco smoking was associated with a 0.72-point decrease (95% CI = 0.14–1.30) in the AQL among males. Twenty (15.7%) male patients reported daily smoking in our study. Among the male patients who smoked tobacco daily, we found statistically significant lower scores ($p < 0.05$) in all four AQL domains, including symptoms, activity limitation, emotional function and

Table 1. Patient characteristics.

	Total (n = 257)		Men (n = 129)		Women (n = 128)		p-value
	No.	%	No.	%	No.	%	
Asthma control							
Uncontrolled (<20)	173	67.8	76	58.9	97	77.0	0.002
Controlled (≥20)	82	32.2	53	41.1	29	23	
Asthma diagnosis in years							
<6	57	23.5	27	22.1	30	24.8	0.627
6-20	138	56.8	68	55.7	70	57.9	
>20	48	19.8	27	22.1	21	17.4	
Perceived asthma severity during the past 4 weeks							
≤5	187	73.3	100	77.5	87	69.0	0.126
>5	68	26.7	29	22.5	39	31.0	
Perceived daily stress during the past 4 weeks							
≤5	187	73.9	97	75.2	90	72.6	0.636
>5	66	26.1	32	24.8	34	27.4	
BMI ^a in kg/m ²							
<25	62	25.4	23	18.5	39	32.5	0.003
25 – 29.99	85	34.8	55	44.4	30	25.0	
≥30	97	39.8	46	37.1	51	42.5	
Age in years							
<25	61	23.8	35	27.1	26	20.5	0.452
25-45	140	54.7	67	51.9	73	57.5	
>45	55	21.5	27	20.9	28	22.0	
Nationality							
Saudi Arabian	249	97.3	124	96.1	125	98.4	0.447
Other	7	2.7	5	3.9	2	1.6	
Residence							
Riyadh	166	64.8	73	56.6	93	73.2	0.005
Other	90	35.2	56	43.4	34	26.8	
Highest level of completed education							
None	18	7.1	6	4.7	12	9.6	0.270
Secondary (or less)	88	34.6	46	35.7	42	33.6	
Bachelor	128	50.4	64	49.6	64	51.2	
Graduate	20	7.9	13	10.1	7	5.6	
Employment status							
Employed	105	41.0	64	49.6	41	32.3	<0.001
Retired/student	61	23.8	43	33.3	18	14.2	
Unemployed, disabled or too ill to work	90	35.2	22	17.1	68	53.5	
Marital status							
Single	72	28.2	42	32.8	30	23.6	0.002
Married	165	64.7	84	65.6	81	63.8	
Divorced/widowed	18	7.1	16	12.6	2	1.6	
Tobacco smoking							
Daily	22	8.7	20	15.7	2	1.6	<0.001
Less than daily or not at all	232	91.3	107	84.3	125	98.4	
Household member smokes inside the house							
Yes	49	19.2	17	13.2	32	25.4	0.013
No	206	80.8	112	86.8	94	74.6	
Monthly household income in SAR ^b							
4,999 or less	35	13.8	15	11.8	20	15.9	0.859
5,000 – 9 999	63	24.9	32	25.2	31	24.6	
10,000 – 14 999	58	22.9	27	21.3	31	24.6	
15,000 – 25 000	45	17.8	25	19.7	20	15.9	
25,000 – 39 999	27	10.7	15	11.8	12	9.5	
40,000 or more	25	9.9	13	10.2	12	9.5	

Note. ^aBody mass index; ^bSaudi Arabian Riyals (USD 1 ≈ SAR 3.75).

Table 2. Overall and domain-specific scores for asthma-specific quality of life by gender.

Domains	Total mean (SD) ^a	Men mean (SD)	Women mean (SD)	p-value
Overall score	4.2 (1.4)	4.3 (1.5)	4.0 (1.3)	0.113
Symptoms	4.1 (1.5)	4.3 (1.6)	3.9 (1.4)	0.067
Activity limitation	4.4 (1.5)	4.5 (1.5)	4.2 (1.4)	0.153
Emotional function	4.3 (1.6)	4.4 (1.7)	4.1 (1.5)	0.192
Environmental stimuli	3.9 (1.5)	3.9 (1.6)	3.8 (1.4)	0.558

Note. ^aStandard deviation.

environmental stimuli. Similar findings have been reported in other studies, indicating the harmful effect of smoking on the quality of life of asthma patients [24,25], although some of these studies observed a difference only in the symptoms and emotional function domains of smokers [24], whereas others found differences in the symptoms and activity limitation [26]. The decreased quality of life might be attributed to increased inflammation in the airways and reduced sensitivity to corticosteroids caused by cigarette smoke [27].

Table 3. Factors associated with asthma-specific quality of life in male and female adult asthma patients (univariate analysis).

Factor	AQL ^a score mean (SD) ^b	Men				Women				
		B ^c	Mean difference	95% CI ^d	p-value	AQL score mean (SD)	B	Mean difference	95% CI	p-value
Asthma control score		0.2		0.1 – 0.2	<0.001		0.2		0.1 – 0.2	<0.001
Perceived asthma severity										
≤5	4.5 (1.6)		0.7	0.2 – 1.2	0.005	4.2 (1.3)		0.5	0.0 – 1.1	0.033
>5	3.8 (1.0)		–			3.7 (1.3)				
Occupation										
Employed/retired/student	4.4 (1.5)		0.5	–0.2 – 1.2	0.138	4.4 (1.5)		0.6	0.2 – 1.1	0.007
Unemployed/disabled or too ill to work	3.9 (1.2)		–	Referent		3.8 (1.3)		–	Referent	
Age										
18–54 years	4.3 (1.5)		0.1	–0.7 – 0.8	0.837	4.2 (1.3)		0.9	0.3 – 1.6	0.008
55 years and older	4.3 (1.3)		–	Referent		3.2 (1.3)		–	Referent	
Tobacco smoking										
Daily	3.5 (1.5)		–	Referent	0.006	–		–	–	–
Less than daily or not at all	4.5 (1.4)		1.0	0.2 – 1.7	–	–		–	–	–
Tobacco smoking inside the house										
Yes	4.3 (1.2)		0.0	–0.8 – 0.8	0.967	3.6 (1.3)		–	Referent	0.024
No	4.3 (1.5)		–	Referent		4.2 (1.3)		0.6	0.1 – 1.1	
Monthly household income in SAR ^e										
< 15,000	4.0 (1.4)		–	Referent		3.7 (1.2)		–	Referent	
15,000 – 24 999	4.5 (1.5)		0.4	–0.4 – 1.2	0.385	4.5 (1.5)		0.8	0.1 – 1.6	0.029
25,000 or more	5.0 (1.5)		1.0	0.2 – 1.7	0.010	4.7 (1.2)		1.0	0.3 – 1.7	0.004

Note. ^aAsthma-specific quality of life; ^bstandard deviation; ^cunstandardized regression coefficient; ^dconfidence interval; ^eSaudi Arabian Riyals. Bold values represent statistical significance.

Only two female patients reported smoking daily, whereas 32 (25.2%) reported having a household member who smokes inside the house. Women who had a household member smoking inside the house had a significantly lower AQL ($B = 0.59$, 95% CI = 0.19–1.00). The harmful effect from smoking inside the house on the health of non-smokers has been consistently reported [28]. Previous studies have reported a significant relationship between environmental tobacco smoke exposure and the reduced quality of life of asthma patients [29]. The hazardous attributes of the third-hand smoke on asthma patients have also been reported [30].

We did not find a statistically significant association between AQL and having a household member who smokes inside the house among the males. A review of the literature by Greaves and his colleagues [31] showed gender differences in secondhand smoke, concluding that low-income women may have difficulties in managing

and controlling their exposure to secondhand smoke at home, which might potentially explain our finding. In addition, Sorheim and colleagues [32] have suggested that the effect of smoking on lung function might be worse for females compared to males. Comhair and colleagues [33] have reported that the levels of systemic superoxide dismutase, a potential target of environmental tobacco smoke, was associated with increased asthma severity in women.

The relationship between socioeconomic factors, such as income and occupation, and the asthma quality of life has been previously reported [15,34]. In our study, we found similar results but with some gender-specific differences. A monthly household income of SAR 25,000 or more was associated with a better AQL among men ($B = 0.51$; 95% CI = 0.01–1.01), whereas being employed was protective for women ($B = 0.48$; 95% CI = 0.11–0.84), compared to women who were unemployed, retired or

Table 4. Independent correlates of asthma-specific quality of life among male asthma patients.

Factor	B ^a	SE ^b	B ^c	t	p-value	95% CI ^d
ACT ^e score	0.19	0.02	0.58	8.241	<0.001	0.14 – 0.23
Smokes tobacco daily	– 0.72	0.29	– 0.17	– 2.444	0.016	– 1.30 – – 0.14
Monthly household income ≥ 25 000 SAR ^f	0.51	0.25	0.14	2.036	0.044	0.01 – 1.01

Note. ^aUnstandardized regression coefficient; ^bstandard error of the coefficient; ^cstandardized coefficient; ^dconfidence interval; ^eAsthma control test; ^fSaudi Arabian Riyals.

Table 5. Independent correlates of asthma-specific quality of life among female asthma patients.

Factor	B ^a	SE ^b	B ^c	t	p-value	95% CI ^d
ACT ^e score	0.21	0.02	0.74	9.657	<0.001	0.16 – 0.25
Perceived asthma severity greater than 5	0.82	0.23	0.29	3.503	0.001	0.36 – 1.28
Smoking tobacco inside the house	– 0.59	0.20	– 0.20	– 2.889	0.005	– 1.00 – – 0.19
Employed	0.48	0.18	0.18	2.608	0.010	0.11 – 0.84

Note. ^aUnstandardized regression coefficient; ^bstandard error of the coefficient; ^cstandardized coefficient; ^dconfidence interval; ^easthma control test.

students (none of the women reported being disabled or too ill to work). Although income is a strong predictor of quality of life [15], previous studies have shown that in developing countries, women are more restricted in health-related expenditures, and they receive less support from their families and society for their disease. At the same time, employed women are more autonomous, with greater decision-making power, which influences their health-related behavior and health outcomes [35]. Our data do not allow us to speculate further on this issue, and additional studies are needed to explore the AQL gender differences that are related to socioeconomic factors in Saudi Arabia.

Finally, higher levels of perceived asthma severity (a score higher than 5) were associated with a better AQL ($B = 0.82$; 95% CI = 0.36–1.28) in women, but no such association was found in men. It was shown that patient perceived asthma severity is substantially different from doctor-rated asthma severity, with lower levels of asthma severity reported by patients, although a different scale of asthma severity was used in that study [36]. Meanwhile, it was reported that underestimating asthma severity can result in inadequate management of the disease and more frequent morbidity [37–39], which can potentially explain our findings that women with the same level of asthma control but with higher perceived diseases severity had a higher asthma-specific quality of life. In addition, there is a different perception of asthma severity by males and females.

For example, Wijnhoven and colleagues [40] have reported that while having higher levels of pulmonary function, men tended to report less severe dyspnea, which is a measure of patient perceived asthma severity [36]. When searching the literature, we found some articles with an opposite relationship between perceived asthma severity and quality of life [41, 42], similar to our univariate analysis, but those studies did not adjust for asthma control in their models. Our findings highlight the need for patients to be aware of the physician-assessed objective severity of their disease.

This study has some limitations, including the cross-sectional nature of the survey, which can restrict us from evaluating the temporal relationships of the variables. Another possible limitation is the use of self-reported data, which can potentially cause bias. The study was conducted only in three primary care centers in Riyadh, Saudi Arabia, which may limit the generalizability of the findings. Having a larger sample size could strengthen the results of our study. A complete measurement property validation for the Arabic version of the questionnaire was not conducted. However, taking into consideration the high quality of cultural adaptation done by MAPI Research Institute (MAPI Institute,

Lyon, Rhone-Alpes, France) and that all other cultural adaptations of this questionnaire done by MAPI Research Institute showed a similar validity measures compared to the original one [43], we think that it did not have a significant impact on our results. Selection bias might have occurred due to differential response rate from patients with different levels of AQL, but we believe that it did not have a substantial influence on our results, because only 7.1% (20/280) of eligible patients refused to participate in the study. Finally, FEV₁, objective severity ratings, medication needs and objective measures of adherence were not assessed at baseline, which could offer alternative explanations for the study findings.

In conclusion, our findings did not identify any statistically significant difference in AQL between males and females, but they did reveal gender-specific differences in the correlates of AQL, and particularly in tobacco exposure, socio-economic factors and perceived asthma severity, which should be considered during the treatment by primary care physicians to improve the AQL of their patients.

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Declaration of interest

The authors report no conflicts of interest.

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