







Factors associated with poor health-related quality of life among patients with asthma: A hospital-based study from Jordan

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ABSTRACT

Purpose: Exploring the factors that are associated with diminished health-related quality of life (HRQOL) in patients with asthma is essential to reach the optimal HRQOL. This study aim to assess HRQOL and its associated factors in patients with asthma in Jordan.

Methods: This cross-sectional study was conducted on patients with asthma attending King Abdullah University Hospital and Jordan University Hospital in Jordan. In addition to socio-demographic variables, the study survey included mini asthma quality of life questionnaire (mini AQLQ) to measure HRQOL and asthma control test (ACT) to assess the degree of asthma control in asthmatic patients. Binary logistic regression was used to build a model of the independent predictors of poor HRQOL in the study participants.

Results: Of the 314 participating patients, 70.1% were females, with a mean age of 51.47±16.37 years. 61.1% of the participants had low HRQOL, with a total mean mini AQLQ score of 4.30±1.30. Results revealed that advanced age (OR=0.961; 95% CI: 0.936-0.986; p<0.05) and lack of daily exercise (OR=0.233; 95% CI: 0.085-0.637; p<0.01) were significant predictors of poor HRQOL in patients with asthma, while better controlled disease, manifested by higher ACT score was associated with better HRQOL in these patients (OR=1.499; 95% CI: 1.344-1.672; p<0.01).

Conclusions: HRQOL represents an area for improvement in patients with asthma. The current study provides insight on the factors associated with poor HRQOL. Future interventions and asthma management programs should focus on improving asthma control and encouraging physical activity, particularly for older patients, with the aim of improving HRQOL among patients with asthma.

Keywords: health-related quality of life, asthma, asthma control, mini AQLQ, factors, Jordan

INTRODUCTION

Asthma is a chronic, debilitating condition that causes the muscles surrounding the airways in the lungs to constrict as a result of inflammation, leading to bothersome symptoms such as coughing, wheezing, shortness of breath, and chest tightness [1, 2]. In 2019, the global prevalence of asthma was estimated to be 262 million cases, with over 455 thousand deaths, inflicting a significant burden on the lives of the individuals affected [3, 4]. In Jordan, the prevalence of asthma with a doctor's diagnosis ranged from 8.8% to 9.5%, and in 2015, it alarmingly approached 10.0% among the elderly [5, 6]. Asthma has been associated with significant clinical and economic burden ranging from an average annual cost of \$366 to \$647 per patient, as well as an increased rate of healthcare resources utilization among asthmatic patients. In addition, asthma has also contributed to the productivity loss and functional impairment, increasing the overall burden [7]. The overall yearly cost of asthma in Jordan was estimated to be

110,874 Jordanian dinar (JD) (US\$ 156,382), with healthcare sources utilization and direct medical expenditures of asthma being substantially connected to disease severity and disease control status [8]. This is alarming because previous research found high prevalence of asthma with severe symptoms in Jordan [9]. When speaking about any chronic disease, it is critical to shed the light on health-related quality of life (HRQOL), which is a common concept that is used to measure the impact of the health status of patients on their quality of life by capturing information related to both physical and mental health [10]. Previous research highlighted high prevalence of psychological distress and the impaired quality of life of asthmatic patients [7]. Several other studies confirmed diminished HRQOL in patients suffering from asthma [11-14].

The primary contributing factors that predict low HRQOL in patients with asthma are not thoroughly known, necessitating a clear understanding of these factors in order to assist in the creation of treatment interventions that are effective in enhancing asthmatic patients' HRQOL. However, the literature

has published conflicting results regarding the predictors of poor HRQOL in patients with asthma. Uncontrolled asthma, for instance, was revealed as a predictor of poor HRQOL in several studies [12, 14-16], while different predictors of poor HRQOL such as gender and disease severity were identified in other studies conducted in Pakistan and Ethiopia [13, 14]. In Spain, education level, severity of daytime symptoms, and patient education on asthma significantly affected HRQOL of asthmatic patients [17]. Another research found that patients with asthma who were suffering from anxiety and depression had poorer quality of life when compared to those without such symptoms [18]. Because of the heterogeneity in the predictors of poor HRQOL in asthma, more research is required to narrow down the diversity and disclose the true influencing variables of asthmatic patients' HRQOL. Findings of the present study should provide a preliminary step for future patients' care programs that aim at improving HRQOL and find effective solutions to overcome barriers for optimum HRQOL in patients with asthma. Thus, current study aim was to assess the HRQOL in patients with asthma and to explore the variables that were associated with poor HRQOL in patients with asthma in Jordan.

METHODS

Study Design and Subjects

This is a cross-sectional study, which was conducted on patients with asthma attending the outpatient respiratory clinics at King Abdullah University Hospital and Jordan University Hospital in the period from September 2021 through March 2022. Patients were included in the study if they were 18 years old or older, had a confirmed diagnosis of asthma for at least six months, stable with no current exacerbation or respiratory tract infection, and agreed to participate in the study. Exclusion criteria included patients with cognitive impairment and those who were unable to read or understand the questionnaire. Research pharmacist clearly explained the study purposes to the eligible participants and informed them that their participation in the study was entirely voluntary and they could withdraw from the study at any time. They were also informed that their medical care at KAUH would not be affected by their participation. The researcher emphasized that the collected data will only be used for research purposes and will be saved in the principal investigator's office to ensure data confidentiality. Patients who agreed to take part in the study were required to sign an informed consent form. A custom-designed questionnaire was used to collect information on socio-demographic variables such as age, gender, educational status, average income, family history of asthma, doing exercise and the frequency of exercise per day (<one hour/>one hour), having sinusitis, and presence of any allergies. Patients' interview and medical files were used to collect information about the disease and medication-related characteristics including medications used for asthma management such as salbutamol or short-acting B2 agonist (SABA), long-acting B2 agonist (LABA), prednisolone, inhaled corticosteroids (ICS), and long-acting muscarinic antagonist (LAMA), other medications, comorbidities, and pulmonary function tests (FEV1 and FVC). Due to the importance of inhaler technique in asthma management [19], appropriate use of inhalers and patients' exposure to triggers for asthma exacerbation were assessed using special checklists [20].

Study Instruments

Mini asthma quality of life questionnaire

Mini asthma quality of life questionnaire (mini AQLQ) is a validated shorter version derived from the original 32-item AQLQ, which was created for the purpose of measuring HRQOL in patients with asthma [21]. This 15-item instrument assessed HRQOL in several domains including environmental related symptoms, emotional related symptoms, and activities limitations. Patients were asked to rate the degree to which their asthma impaired their functioning in the last two weeks on a seven-point Lickert scale ranging from one (all of the time) to seven (none of the time), with lower scores indicating poorer HRQOL. A mean score for each item and a total mini AQLQ mean score was calculated. The Arabic version of this questionnaire was used in this study. The internal consistency of mini AQLQ scale was established using Cronbach alpha, which equals 0.930.

Asthma control test

This validated instrument included five items assessing patients' asthma symptoms, their use of rescue medications, and the impact of asthma on their daily life within the past four weeks to determine how well controlled was their asthma [22]. Total scores range from five to 25 with higher scores indicating better asthma control. A score of 25 indicated full control, 20-24 indicated controlled disease, 16-19 indicated partial control, and a score of 15 or less indicated poorly controlled asthma. The validity and reliability of asthma control test (ACT) has been determined previous research [23]. The validated Arabic version of ACT was used to assess asthma control in this study [24]. The reliability of ACT scale was established using Cronbach alpha, which equals 0.903. The study instruments were survey evaluated by three experts in the field who confirmed the suitability of the instruments to assess the outcomes in the present study.

Sample Size Calculation

50+8p equation was used to compute minimum required sample size required, where p is the number of predictors in the regression model. The original aim of the study was to evaluate the association of the twenty variables with HRQOL. Thus, minimum required sample size was 210 [25].

Statistical Analysis

Data were coded and analyzed using SPSS software (version 27; IBM SPSS, Armonk, NY, USA). Categorical variables were described as frequency (%) while continuous variables were described as means \pm SD. Different scores were computed based on participants' answers to the designated questions. The scores included exposure to environmental irritants including, pets, dust, passive smoke, pollen, air pollution, humidity, black mold and cockroaches, and inhaler score percent, which was computed based on the inhaler checklist. Receiver operating characteristic (ROC) curve was produced by plotting the sensitivity to 1-selectivity using ACT classification as the state variable and mini AQLQ score as the test variable (ref: the meaning and use of the area under a receiver operating characteristic (ROC) curve; radiology). The produced area under the curve was examined and the cut-off point was determined based on Youden index then the participants were divided based on cut-off point produced by ROC analysis into high and low quality of life groups. Bivariate analysis was conducted using Chi-square and Mann-Whitney U to determine

Table 1. Socio-demographic characteristics of study participants (n=314)

		Female (n=220)	Male (n=94)
		Frequency (%) or mean±SD	Frequency (%) or mean±SD
Age		52±16	50±18
Educational status	Low education	81 (36.8%)	16 (17.0%)
	High education	139 (63.2%)	78 (83.0%)
Average income	Low	34 (15.5%)	12 (12.8%)
	Moderate	159 (72.3%)	68 (72.3%)
	High	27 (12.3%)	14 (14.9%)
Family history of asthma	Yes	70 (31.8%)	30 (31.9%)
	No	150 (68.2%)	64 (68.1%)
Daily exercise	No	92 (41.7%)	26 (27.7%)
	< One hour/day	87 (39.4%)	33 (35.1%)
	> One hour/day	41 (18.8%)	35 (37.2%)
Having any kind of allergy	No	201 (91.4%)	88 (93.6%)
	Yes	19 (8.6%)	6 (6.4%)

Table 2. Medical information of study participants

		Female (n=220)	Male (n=94)
		Frequency (%) or mean±SD	Frequency (%) or mean±SD
Comorbidities	Having dyslipidemia	No	151 (68.6%)
		Yes	69 (31.4%)
	Having hypertension	No	105 (47.7%)
		Yes	115 (52.3%)
	Having diabetes mellitus	No	148 (67.3%)
		Yes	72 (32.7%)
Having sinusitis	No	86 (39.1%)	
	Yes	134 (60.9%)	
Asthma medications	Receiving salbutamol as needed	No	132 (60.0%)
		Yes	88 (40.0%)
	Receiving LABA	No	28 (12.7%)
		Yes	192 (87.3%)
	Receiving prednisolone	No	214 (97.3%)
		Yes	6 (2.7%)
	Receiving ICS	Not taking	37 (16.8%)
		Low ICS dose	103 (46.8%)
		Moderate ICS dose	65 (29.5%)
		High ICS dose	15 (6.8%)
Receiving LAMA	No	164 (74.5%)	
	Yes	56 (25.5%)	
Receiving beta blockers	No	189 (85.9%)	
	Yes	31 (14.1%)	
Receiving NSAIDs	No	191 (86.8%)	
	Yes	29 (13.2%)	
Pulmonary function tests	FEV1 (L)	2.00±0.47	
	FVC (L)	2.41±0.46	
	FEV1/FVC%	0.82±0.06	
	FEV1%	0.78±0.16	
	FVC%	0.82±12.98	
Inhaler technique checklist score		87.46±13.39	

Note. ICS: Inhaled corticosteroids; LABA: Long-acting B₂ agonist; LAMA: Long-acting muscarinic antagonist; NSAID: Non-steroidal anti-inflammatory drug; SD: Standard deviation; FEV: Forced expiratory volume; & FVC: Forced vital capacity

variables association with mini AQLQ level. Binary logistic regression model including mini AQLQ level as dependent variable, while independent variables were the variables that were significant in the bivariable analysis ($p < 0.05$).

RESULTS

Demographic Characteristics of Study Participants

Out of 420 patients who were invited to participate, 314 patients (220 females) agreed to participate, with a response rate of 74.8%. The mean age was 51.47±16.37 years; (52±16 for

female vs. 50±18 for male). Most of the participants were females (70.1%), had high educational status (83.0% male vs. 62.3% female), had moderate average income (72.3% for both genders), and had no family history of asthma (68.2% female vs. 68.1% male). Further details about the socio-demographic characteristics of the study participants are available in **Table 1**.

Medical Profile of Participants

As shown in **Table 2**, the most prescribed medication for females was LABA (87.3%) followed by ICS (83.2%), similarly the most prescribed medications for males were LABA and ICS (79.8% and 75.5%, respectively). Furthermore, most of the

Table 3. Description of HRQOL (mini AQLQ/environmental & emotional related symptoms) among study participants (n=314)

Items	AT	MT	GBT	ST	ALT	HAT	NT	Mean±SD
Environmental related symptoms								3.32±1.53
In general, how much of the time during the last two weeks you: Feel short of breath as a result of your asthma?	55 (17.5%)	53 (16.9%)	52 (16.6%)	72 (22.9%)	52 (16.6%)	23 (7.3%)	7 (2.2%)	3.35±1.63
In general, how much of time during last two weeks did you: Feel bothered by or have to avoid dust in the environment?	74 (23.6%)	87 (27.7%)	27 (8.6%)	43 (13.7%)	39 (12.4%)	36 (11.5%)	8 (2.5%)	3.08±1.82
In general, how much of the time during the last two weeks did you: Feel bothered by coughing?	36 (11.5%)	84 (26.8%)	33 (10.5%)	58 (18.5%)	45 (14.3%)	36 (11.5%)	22 (7.0%)	3.60±1.81
In general, how much of time during last two weeks did you: Experience a feeling of chest tightness or chest heaviness?	26 (8.3%)	98 (31.2%)	41 (13.1%)	45 (14.3%)	40 (12.7%)	43 (13.7%)	21 (6.7%)	3.60±1.80
In general, how much of time during last two weeks did you: Feel bothered by/have to avoid cigarette smoke in environment?	71 (22.6%)	94 (29.9%)	26 (8.3%)	33 (10.5%)	33 (10.5%)	43 (13.7%)	14 (4.5%)	3.15±1.91
In general, how much of time during last two weeks did you: Feel bothered by/have to avoid going outside due to weather or air pollution?	61 (19.4%)	101 (32.2%)	32 (10.2%)	35 (11.1%)	30 (9.6%)	41 (13.1%)	14 (4.5%)	3.16±1.86
Emotional related symptoms								4.64±1.42
In general, how much of time during last two weeks did you: Feel frustrated as a result of your asthma?	13 (4.1%)	25 (8.0%)	29 (9.2%)	57 (18.2%)	46 (14.6%)	97 (30.9%)	47 (15.0%)	4.84±1.68
In general, how much of time during last two weeks did you: Feel afraid of not having your asthma medication available?	20 (6.4%)	21 (6.7%)	23 (7.3%)	56 (17.8%)	44 (14.0%)	92 (29.3%)	58 (18.5%)	4.88±1.77
In general, how much of time during last two weeks did you: Have difficulty getting a good night's sleep as a result of your asthma?	27 (8.6%)	41 (13.1%)	32 (10.2%)	33 (10.5%)	42 (13.4%)	74 (23.6%)	65 (20.7%)	4.61± 2.00
In general, how much of time during last two weeks did you: Feel concerned about having asthma?	15 (4.8%)	38 (12.1%)	32 (10.2%)	48 (15.3%)	49 (15.6%)	84 (26.8%)	48 (15.3%)	4.66±1.79
In general, how much of time during last two weeks did you: Experience a wheeze in your chest?	19 (6.1%)	55 (17.5%)	37 (11.8%)	50 (15.9%)	66 (21%)	54 (17.2%)	33 (10.5%)	4.22±1.78

Note. AQLQ: Asthma quality of life questionnaire; HRQOL: Health-related quality of life; AT: All time; MT: Most of the time; GBT: A good bit of the time; ST: Some of the time; ALT: A little of the time; HAT: Hardly any of the time; & NT: None of the time

females and males were taking low ICS dose (46.8% and 38.3%, respectively). The means for FEV1, FVC, FEV1/FVC%, FEV1%, and FVC% in females were 2.00, 2.41, 0.82, 0.78, and 0.82 respectively, while for the males were 2.71, 3.37, 0.79, 0.79, and 0.83, respectively. The inhaler technique use mean score for the females and the males was 87.46 and 87.40, respectively.

Participant's Responses to Mini AQLQ

As shown in **Table 3**, environmental related symptoms had a mean of 3.32±1.53. It included 6 items, the highest mean was 3.60±1.81 for “in general, how much of the time during the last 2 weeks did you: feel bothered by coughing?” and “in general, how much of the time during the last two weeks did you: experience a feeling of chest tightness or chest heaviness?”, while most of the participants (32.2%) responded most of time for the item “in general, how much of the time during the last two weeks did you: feel bothered by or have to avoid going outside because of weather or air pollution?”, and the lowest response (2.2%) was none of the time for “in general, how much of the time during the last two weeks did you: feel short of breath as a result of your asthma?”

Moreover, emotional related symptoms had a mean of 4.64±1.42, it included five items with the highest mean of 4.88±1.77 for the item “In general, how much of the time during the last two weeks did you: feel afraid of not having your asthma medication available?”, the majority of participants (30.9%) responded hardly any of the time for “In general, how much of the time during the last two weeks did you: feel frustrated as a result of your asthma?”, and the lowest response was all of the time (4.1%) for the same item.

As for the activity limitations the mean was 4.94±1.74, it included four items, the highest mean 5.09±1.85 was observed by the item “how limited have you been during the last two weeks doing these activities as a result of your asthma (moderate activities [such as walking, housework, gardening, shopping, climbing stairs])”, and the highest response was not

at all limited (30.6%) for the items “How limited have you been during the last two weeks doing these activities as a result of your asthma (moderate activities [such as walking, housework, gardening, shopping, climbing stairs])” and “how limited have you been during the last two weeks doing these activities as a result of your asthma (work-related activities [such as tasks you have to do at work])”, while the lowest response was very limited (4.5%) for the item “how limited have you been during the last two weeks doing these activities as a result of your asthma (work-related activities (such as tasks you have to do at work))”. The total mini AQLQ mean score was 4.30±1.30.

Further information on the activity limitation is presented in **Table 4**.

Variables Associated With HRQOL

The results of ROC indicated that the most suitable cut-off point for mini AQLQ was 4.741, and the participants were divided accordingly to high/low quality of life groups. Univariate analysis using Chi-square and Mann-Whitney U test showed that age, education, income, oral steroids, respiratory infection, daily exercise, dyslipidemia, hypertension, sinusitis, inhaler score percent, and ACT score were associated with HRQOL in the present study. Binary regression model was fitted to evaluate unique variables association with mini AQLQ level. Results revealed that increased age significantly decreased the odd of being in the higher mini AQLQ level (OR=0.961; 95% CI: 0.936-0.986; p<0.05).

The participants who did not exercise regularly had less odds to be in the high Mini AQLQ level group (OR=0.233; 95% CI: 0.085-0.637; p<0.01) when compared to the participants who exercise more than one hour a day. On the other hand, participants with higher ACT scores had significantly more odds to be in high mini AQLQ level group (OR=1.499; 95% CI: 1.344-1.672; p<0.01). Multivariate analysis results of the factors associated with HRQOL are available in **Table 5**.

Table 4. Description of HRQOL (mini AQLQ/activity limitation) among study participants (n=314)

	Totally limited	Extremely limited	Very limited	Moderate limitation	Some limitation	A little limitation	Not at all limited	Mean±SD
Activity limitation								4.94±1.74
How limited have you been during the last two weeks doing these activities as a result of your asthma (strenuous activities [such as hurrying, exercising, running up stairs, sports]).	33 (10.5%)	34 (10.8%)	19 (6.1%)	47 (15.0%)	59 (18.8%)	69 (22.0%)	53 (16.9%)	4.54±1.94
How limited have you been during last 2 weeks doing these activities as a result of your asthma (moderate activities [such as walking, housework, gardening, shopping, climbing stairs]).	17 (5.4%)	25 (8.0%)	23 (7.3%)	36 (11.5%)	55 (17.5%)	62 (19.7%)	96 (30.6%)	5.09±1.8
How limited have you been during the last 2 weeks doing these activities as a result of your asthma (social activities [such as talking, playing with pets/children, visiting friends/relatives]).	18 (5.7%)	28 (8.9%)	17 (5.4%)	41 (13.1%)	56 (17.8%)	67 (21.3%)	87 (27.7%)	5.03±1.84
How limited have you been during the last 2 weeks doing these activities as a result of your asthma (work-related activities [such as tasks you have to do at work])	19 (6.1%)	25 (8.0%)	14 (4.5%)	46 (14.6%)	56 (17.8%)	58 (18.5%)	96 (30.6%)	5.08±1.85

Note. Mini AQLQ score=4.30±1.30; AQLQ: Asthma quality of life questionnaire; & HRQOL: Health-related quality of life

Table 5. Multivariate analysis of factors associated with HRQOL

Items	p-value	OR	CI	
			Lower	Upper
Age	0.003*	0.961	0.936	0.986
ACT score	0.000*	1.499	1.344	1.672
Lack of daily exercise	0.005*	0.233	0.085	0.637
Exercising <1 hour/day	0.653	0.824	0.354	1.919
Exercising >1 hour/day		Reference		

Note. ACT: Asthma control test; HRQOL: Health-related quality of life; *Significant at p<0.01; & CI: Confidence interval

DISCUSSION

As the case with any chronic disease, asthma can impair the quality of life of asthmatic patients in several ways such as reducing their work productivity and limiting their physical activity [26]. Although this study was not the first one in Jordan to assess HRQOL in patients with asthma, it should provide a deeper understanding and broader insights about HRQOL and its associated factors among asthmatic patients since it was conducted across the north and middle of Jordan and not restricted to the south region of the country as was done in the previous Jordanian study [12]. The results of the current study appear to confirm the substantial effect of asthma on HRQOL, which was moderately reduced among the affected patients, with a total mean mini AQLQ score of 4.3 and over half of the participants (61.2%) reporting low HRQOL. Similar results were reported in earlier studies, which utilized mini AQLQ [13] or AQLQ tools [10, 18] to assess HRQOL in the participating asthmatics. A study conducted in Nigeria reported low HRQOL among the asthmatic patients after they responded to AQLQ instrument [28]. Another survey of over 10 thousand patients in USA found that HRQOL of patients with asthma was lower than that of individuals without the disease [29]. Nonetheless, superior HRQOL ratings were observed in other studies done in Portugal [21, 22], Iran [32], Sweden [33], and USA [34].

Advanced age was revealed as an independent predictor of poor HRQOL in the present study. Consistent findings were reported in studies conducted in Spain [15], USA [29], and Pakistan [14]. Other studies conducted in Portugal [30] and Iran [32] found that young participants had higher HRQOL scores than the older ones. A distinct picture emerged in Jordanian children with asthma, where younger age was associated with

lower HRQOL, possibly as a result of their poor adherence to their treatment plan [35]. The fact that elderly people are more susceptible to comorbidities and complications that decrease their quality of life might be one explanation for this finding. Furthermore, older asthmatic patients have a higher morbidity and mortality rate than younger patients, as evidenced by the larger number of hospitalizations and longer hospital stays, as well as accounting for more than half of all asthma-related deaths [36-39]. Therefore, more attention should be paid to this population, and specific disease management guidelines for the management of asthma in older asthmatics should be developed in order to improve their HRQOL and health outcomes, thereby lowering the burden of asthma on patients and the healthcare system. A distinct picture emerged in Jordanian children with asthma, where younger age was associated with lower HRQOL, possibly as a result of their poor adherence to their treatment plan.

Physical activity has many benefits on humans' body such as the improvement of overall health as well as the strengthening of bones and muscles, enhancing immunity, reducing weight, lowering blood pressure, reducing stress, and many other benefits that improve the quality of life both mentally and physically [40]. That was clearly confirmed by the current study findings, where asthmatic patients who were not performing daily exercise had significantly worse HRQOL than those who were exercising daily. Consistent results were found in a study conducted among adolescents with asthma, which concluded that higher levels of physical activity reflected better quality of life among the participating patients [41]. A systematic review of the effect of physical activity on the quality of life of asthmatic patients reported that all aerobic training programs studied showed positive effect on the quality of life [42]. Another review reported that physical inactivity negatively affected asthmatic patients' health and increased asthma-related difficulties. Regular aerobic exercise, on the other hand, improved asthma symptom management, lung function, and mental health of these patients [43]. Besides the routine therapeutic guidelines for asthma management, these findings should provide an insight into the necessity of healthcare providers to advise asthmatic patients to routine exercise for its general health benefits and likely improvement in asthma symptoms and quality of life [44].

Consistent with the results reported in prior research [12, 45, 46], our study found a significant relationship between poor disease control and poor HRQOL. The degree of asthma control has been found to play a significant role in determining the quality of life of asthmatic patients in several other studies. A one-year prospective Italian study of over one thousand asthmatic patients whose disease was uncontrolled or partially controlled reported that improvement of asthma control over time was associated with improved quality of life assessed using EuroQoL-5D questionnaire, which was filled in and collected during multiple clinical visits [47]. In addition, HRQOL in patients with difficult to control asthma was reported to be substantially impaired [50]. Another study conducted in Pakistan reported that poor control of asthma was one of the factors responsible for poor quality of life among patients with asthma [14]. Poor asthma control has been also found to negatively impact asthmatic patients' HRQOL in all its dimensions, manifested by low EQ-5D scores in a Spanish study [15]. Moreover, a 12-year follow-up cohort study reported that HRQOL scores were significantly lower in patients with uncontrolled asthma when compared with those with controlled asthma using the 15D questionnaire [16]. A study conducted in Turkey showed that patients with uncontrolled asthma had lower quality of life score and higher anxiety and depression scores than their counterparts [27]. Proper asthma control is an extremely important goal that is still not achieved despite the treatment standards introduced [36-38]. Therefore, therapeutic guidelines should pay attention to the importance of developing future asthma management programs that aim at investigating the factors that hinder proper control of asthma and implementing effective strategies that overcome these factors and enhance the control of asthma symptoms, and thus, improving HRQOL in asthmatic patients.

In summary, healthcare providers need to pay close attention to the age of the patients and the factors that could impact asthma control with a focus on self-management practice when developing individualized treatment plans, which aim at improving HRQOL among patients with asthma. Furthermore, due to the potential role of physical activity in improving quality of life of patients with asthma, health care providers should incorporate personalized physical activity regimens tailored to the patients' asthma severity, while ensuring safety and avoiding exacerbation to improve HRQOL of asthmatic patients and reduce the burden of the disease.

The current study can have several strengths that would enhance the reliability and validity of the findings. The use of disease-specific instruments, such as the mini AQLQ, would have helped draw more accurate and sensitive results concerning the impact of asthma on HRQOL, since it was designed to capture the unique aspects of asthma that impact HRQOL, such as shortness of breath, wheezing, and coughing. In addition, conducting a multidimensional assessment of HRQOL including physical, emotional, and social aspects can capture the full impact of asthma on HRQOL. Recruiting patients from two major hospitals and from different geographical area can enhance the generalizability of our study findings. Furthermore, performing adequate statistical analysis with regression models can identify the most important predictors of HRQOL, and account for potential confounding variables. However, the cross-sectional study design cannot confirm the cause-effect relationship, and the convenient sampling technique used in this study might cause selection bias.

CONCLUSIONS

The current study proved that patients with asthma had poor HRQOL, with advanced age, lack of regular physical exercise, and poor asthma control being the main contributing factors of reduced HRQOL. With special focus on the elderly population, future asthma care initiatives should develop effective strategies to improve asthma control and encourage patients with asthma to exercise regularly, in order to enhance HRQOL and improve health outcomes of these patients.

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Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

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