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Association between medication adherence and quality of life of patients with diabetes and hypertension attending primary care clinics: a cross-sectional survey

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Abstract

Purpose To evaluate the association between medication adherence and quality of life (QoL) of patients with diabetes and/or hypertension attending primary care clinics.

Methods In this cross-sectional study, patients with at least one long-term condition (hypertension or diabetes mellitus) meeting the eligibility criteria were recruited from five primary care clinics in Saudi Arabia. Arabic version of Morisky Medication Adherence Scale (MMAS-8) and the World Health Organization Quality of Life-BREF (WHOQOL-BREF) tool were used to assess medication adherence and QoL, respectively. Patients' sociodemographic, medical and medication data were collected using a structured, pilot-tested data collection form.

Results Three hundred patients with a mean (± SD) age of 56.79 (12.8) years participated in the study. Fifty-eight had hypertension only, 96 had diabetes (Type 1 or 2), and 146 had both hypertension and diabetes. After adjusting for socioeconomic characteristics, multiple linear regression analysis found that adherent patients had significantly higher mean overall perception of QoL and health scores by 14.6 ($P=0.001$) and 17.2 ($P=0.001$) points, respectively, compared to non-adherent patients. In addition, irrespective of the type of long-term condition, adherence status was found to be an independent predictor of all QoL domains.

Conclusion There is an association between medication adherence and QoL among patients with diabetes and/or hypertension attending primary care clinics. Medication adherence should be assessed and emphasised during routine clinical consultations in primary care in order to achieve the desired clinical outcomes and overall well-being of patients.

Keywords Medication adherence · Quality of life · Compliance · Hypertension · Diabetes mellitus · Primary care

Introduction

One in every two appointments in primary care with a physician is attributed to long-term conditions (e.g. hypertension, diabetes, arthritis, etc.) [1]. It has been estimated that 70% of the total health and social care expenditure is spent on the treatment of patients with long-term conditions [1]. Since patients with long-term conditions are living longer and receiving treatment for an extended period, quality of life (QoL) has become an important outcome measure to assess the effectiveness of any disease management plan. This is perhaps because poor QoL has been associated with poor therapeutic response, disease progression, and development of disease-related complications [2].

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Medication non-adherence is a common problem in patients with long-term conditions [3, 4]. Studies have showed that adherence rates are typically higher among patients with acute illness, compared to those with chronic ones especially after the first 6 months of starting their therapy [3, 5–7]. Medication adherence rate averages only 50% in the developed world and is estimated to be even lower in developing countries [8]. A number of reasons for non-adherence have been identified in literature and include patients' poor awareness about the importance of adherence, patients cannot adequately assess the benefit–risk ratio of taking their medications, too complex medication regimen (multiple doses), and patients' insufficient knowledge about their medications [9].

In Saudi Arabia, chronic diseases or long-term conditions are the primary cause of morbidity and mortality [10]. The national epidemiological data have noticed a remarkable increase in the incidence and prevalence of long-term conditions such as diabetes mellitus, hypertension, and other cardiac diseases [10]. It has been estimated that one in four Saudi adults suffer from hypertension [11], and one in three suffer from diabetes mellitus, approximately [12]. In addition, chronic non-communicable diseases account for 71% of all deaths in the Saudi Arabia with cardiovascular diseases being the leading cause of death [10].

In Saudi Arabia, previous studies have assessed medication adherence in different medical conditions such as diabetes mellitus (either Type 1 or 2), hypertension, asthma, and epilepsy [13–23]. However, none of the previous studies has assessed the association between medication adherence and QoL of patients with chronic diseases within primary care setting. The main objective of this study was to assess the association between medication adherence and QoL of patients with diabetes and/or hypertension attending primary care clinics in Makkah, Saudi Arabia. Makkah region had the highest number of visits to general and chronic diseases clinics at the Ministry of Health (MOH) hospitals compared to other regions in the country [24]. A secondary objective was to assess the impact of interaction between disease type and medication adherence on QoL.

Methods

Ethics approval

Ethics approval was obtained from the Institutional Review Board (IRB) at the Faculty of Pharmacy, Umm Al-Qura University, Makkah, Saudi Arabia. In addition, ethics and governance approval were also sought from the General Directorate of Health Affairs of Makkah Region, Ministry of Health, Saudi Arabia (Ref # M/47/402/2,646,280). All patients completed written consent forms prior to enrolment in the study.

Participants and settings

A cross-sectional methodology was used in this study. Data were collected from five different primary care clinics between January and May 2016 in Makkah city, Saudi Arabia. The clinics were selected conveniently from four different districts in Makkah city to ensure representation of the various socioeconomic classes.

Patients were included in the study if they were over 18 years of age; had a confirmed diagnosis of diabetes (either Type 1 or 2) or hypertension or both for at least 6 months; taking at least one medication for their diabetes and/or hypertension conditions; and able to communicate in Arabic. Pregnant women, patients with mental health issues, cancer and any other terminal illness, and unwilling to participate in the study were excluded.

Primary care physicians (PCPs) or attending nurses at the participating clinics screened patients' medical records for eligibility. The files of patients meeting the inclusion criteria were marked as potential participants and when they attended their routine consultations with their PCPs, they were asked to participate and complete the questionnaires in the waiting room after obtaining informed consent. Patients were assisted, where required, by the physicians or attending nurses in completing the questionnaires. A consecutive sampling strategy was used for patient recruitment, i.e. all patients attending the clinics during the study period were asked to participate if they met the inclusion criteria, there were no selection criteria for the patients.

Data collection

Two self-administered and validated questionnaires, Morisky Medication Adherence Scale (MMAS-8) and World Health Organization Quality of Life-BREF (WHOQOL-BREF) tool were used to assess medication adherence and QoL, respectively [25–28].

Both questionnaires were administered in the Arabic language as Arabic is the national language of Saudi Arabia. MMAS-8 is an eight-item valid and reliable questionnaire, originally developed in the English language [25]. Seven items in the scale have dichotomous responses (yes/no) to avoid acquiescence bias. Whereas one item uses 5-point Likert-type scale (never/rarely, once in a while, sometimes, usually, and all the time). The minimum score is zero and the maximum is 8. The summated total score is categorised into the following three categories: < 6 = low/non-adherence; 6 to < 8 = medium adherence; 8 = high adherence [25–27].

WHOQOL-BREF is a generic QoL instrument developed by the WHO to measure QoL in patients with different

disease conditions, severity of illness, and cultural subgroups [28, 29]. WHOQOL-BREF is a shorter version of a 100-item tool called WHOQOL-100 [30]. WHOQOL-BREF consists of 26 items and assesses QoL across four domains: physical health (7-items), psychological health (6-items), social relationships (3-items), and environment (8-items). One of the two remaining questions assesses individuals' overall perception of QoL and the other assesses overall perception of health. All items/questions in the instrument except for question numbers 3, 4, and 26 are scaled in a positive direction from 1 to 5 (i.e. high score indicates good QoL). The domain score is calculated from the mean score of all items within each domain [29]. In order to make domain scores comparable to WHOQOL-100, mean scores are multiplied by 4 [29]. A permission and license agreement was signed by the appropriate authority for using both MMAS-8 and WHOQOL-BREF tool. The validity and reliability of WHOQOL-BREF have been very well established [31, 32]. A standardised pilot-tested data collection form was used to collect data on patients' sociodemographic characteristics (e.g. age, gender, employment status), medical and medication histories. The patients completed the sociodemographic section of the data collection form and medical and medication history data were gathered by a nurse by reviewing patients' medical record.

Statistical analysis

All analyses were performed using the statistical software SPSS Version 23 (SPSS Inc., Chicago, IL, USA) for windows. Continuous data were described using means and standard deviation.

Forced-entry multiple linear regression models were constructed to assess the effect of adherence on each domain of the QoL while adjusting the estimates for various sociodemographic variables including age, gender, smoking status, employment status, income, number of medicines, number of children, BMI, and level of education. Only complete cases were used in the regression analysis. Moreover, between groups' effect of adherence level and disease type was assessed using two-way ANOVA. When a significant interaction was present, the effect of each factor (adherence level/disease type) was evaluated within each group. A P-value of ≤ 0.05 was considered statistically significant.

Results

A total of 300 patients were recruited during the study period. Fifty-eight (19.3%) patients had hypertension only, 96 (32%) had diabetes mellitus either Type 1 or 2, and 146 (48.6%) had both hypertension and diabetes mellitus. The mean (SD) age was 56.8 (± 12.8 years). More than half of the patients were females (64%), unemployed (60.3%), and obese (58%). The mean (SD) number of current medications was four (± 2), with the majority of the patients having at least two comorbidities. The demographic characteristics of the participants are shown in Table 1.

Patients' blood pressure was considered controlled or uncontrolled according to the NICE guidelines for hypertension in adult patients [33]. A clinic blood pressure was considered controlled if it was (1) below 140/90 mmHg in patient aged under 80 years old with treated hypertension, (2) below 150/90 mmHg in patient aged 80 years and over with treated hypertension, and (3) below 140/80 mmHg in patient with both hypertension and diabetes or below130/80 mmHg in the presence of nephropathy, retinopathy, or neurological complications [33, 34]. On the other hand, the level of HbA1C was considered controlled if it achieves (1) 7% (53 mmol/mol) in patient taking drug associated with hypoglycaemia, and (2) 6.5% (48 mmol/mol) in patient managed by lifestyle modification and diet (or by lifestyle modification and diet with a single drug not associated with hypoglycaemia) [34]. This was followed and considered by all participating physicians.

Of the 300 patients included in this study, 163 (54.3%) had low adherence score (score < 6), 72 (24%) had medium (score = 6 to < 8), and only 65 (21.7%) had high adherence score. The mean (SD) overall perception of QoL and overall perception of health were 68.5 (21.1) and 68.7 (23.6), respectively. Table 2 shows the mean (SD) scores of the four QoL domains stratified by different socioeconomic characteristics. The mean (± SD) scores for the two individual questions assessing over all perception of QoL and health have also been presented. Male, university educated and married patients had higher overall mean QoL score compared to other relative groups.

Multiple regression analysis found that medication adherence was an independent predictor of QoL among patients with diabetes and/or hypertension after adjusting for various socioeconomic factors ($P < 0.001$) (gender, age, level of education, income status, marital, and smoking status). Furthermore, adherent patients had significantly higher mean overall perception of QoL and overall perception of health score by 14.6 ($P = 0.001$) and 17.2 ($P = 0.001$) points compared to non-adherent patients. (Table 3). Similarly, male patients had significantly better mean overall perception of QoL and overall perception of health scores by 9.4 ($P = 0.001$) and 11.6 ($P = 0.001$) points, respectively, compared to female patients. Patients who were not satisfied with their income had lower mean overall QoL and overall perception of health scores by 7.5 ($P = 0.001$) and 6.6 points, respectively ($P = 0.03$).

Two-way analysis of variance (ANOVA) was also conducted to assess the effect of interaction of disease type and adherence level on the four QoL domains and the two

Table 1 Patients' demographics and health status

Demographic variables	Total study population ($N=300$)	
	N	%
Gender		
Female	192	64
Male	108	36
Age		
Mean (SD)	56.8 (12.8)	–
19–35 years	15	5
36–50 years	79	26.3
51–65 years	145	48.3
66–85 years	53	17.7
>85 years	8	2.7
BMI		
Underweight	1	0.3
Normal	28	9.3
Overweight	97	32.3
Obese	174	58
Level of education		
Literate	123	41
Elementary/intermediate school	76	25.3
High school	60	20
BS degree and higher	41	13.7
Employment status		
Employed	59	19.7
Non-employed	181	60.3
Retired	60	20
Income status		
Satisfied	245	81.7
Unsatisfied	55	18.3
Marital status		
Single	13	4.3
Married	233	77.7
Divorced	15	5
Widow	39	13
Number of children		
No children	24	8
1–2 children	25	8.3
3–5 children	131	43.7
>5 children	120	40
Smoking status		
Smoking	43	14.3
Non-smoking	257	85.7
Number of comorbidities		
2 comorbidities	186	62
3 comorbidities	70	23.3
≥4 comorbidities	44	14.7
Number of current medications		
Mean (SD)	4 (2)	–
1 medication	17	5.7
2 medications	48	16
3 medications	59	19.7
4 medications	72	24
5 medications	46	15.3
≥6 medications	58	19.3
Blood pressure[a]		
Controlled	142	47.3
Uncontrolled	62	20.7
Not a hypertensive patient	96	32
HbA1C[a]		
Controlled	67	22.3
Uncontrolled	174	58
Missing/not reported data	1	0.3
Not a diabetic patient	58	19.3
Diabetic medications		
Insulin only	66	22
Oral hypoglycaemic only	223	74.3
Both	47	15.7

N number of patients, *SD* standard deviation, *BMI* body mass index, *HbA1C* haemoglobin A1C

[a]See text for cut-off values to describe controlled and uncontrolled blood pressure and HbA1C

individual questions (Table 4). Adherence level was found to be an independent predictor of QoL irrespective of the disease type.

Discussion

The current study aimed to evaluate the association between medication adherence and QoL among adult patients with diabetes and/or hypertension in primary care in Makkah, Saudi Arabia. The current study adds to the existing literature highlighting the importance of medication adherence in long-term conditions by assessing the impact of interaction between disease type and adherence level on QoL, in addition to assessing association between medication adherence and QoL.

Patients with long-term conditions such as diabetes and hypertension are twice as likely to report sub-optimal physical health, moderate to severe emotional problems, restriction in social relationships, and having poor health compared to patients without chronic illnesses [35]. In our study, adherent patients had significantly better QoL compared to non-adherent patients irrespective of the type of the long-term condition (either having diabetes only or hypertension only or having both diabetes and hypertension). A

Table 2 Means of the quality of life scores between sociodemographic and clinical characteristics of the sampled patients

Variables	Quality of life domains				Overall perception of QoL	Overall perception of health
	Physical health	Psychological	Social relationship	Environment		
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Gender						
Male	67.1 (14.5)	76.6 (14.7)	67.2 (17.5)	72.1 (15.5)	77.8 (17.7)	78.5 (17.6)
Female	58.8 (16.8)	61.8 (14.1)	69.2 (15.4)	60.8 (14.2)	63.4 (21)	63.3 (24.7)
Level of education						
No formal education	57.7 (17.5)	61.8 (15.5)	67.4 (17.7)	60.6 (14.9)	62.4 (21.7)	64 (25)
Elem/mid School	61.2 (16.3)	66.2 (13.9)	66.5 (14.4)	62.2 (14.7)	66 (17.7)	66.1 (21.8)
High school	66.6 (16)	73.2 (15.7)	70 (14.6)	70.4 (15.0)	72.9 (19.6)	76.2 (18)
BS degree/higher	67.8 (9.8)	76.0 (14.8)	73.5 (16.0)	74.6 (13.8)	85.6 (15.9)	76.8 (25.2)
Income status						
Satisfied	64.6 (15.5)	69.4 (15.7)	69.7 (16.3)	67.7 (14.7)	71 (20.4)	70.9 (23)
Unsatisfied	49.2 (14.9)	56.7 (12.9)	62.9 (14.5)	52.1 (13.1)	57.4 (20.3)	59 (23.7)
Marital status						
Single	67.1 (15.4)	65.9 (14.3)	69.2 (14.5)	66.2 (12.8)	65.4 (16.2)	69.2 (20.8)
Married	63 (16.7)	68.5 (16.6)	68.3 (16.4)	66.5 (15.8)	70.7 (21.3)	70.7 (23.2)
Divorced	53.8 (17.8)	63 (13.9)	65.3 (19.8)	58.1 (15.5)	66.6 (22.5)	55 (28.6)
Widow	55.1 (12.5)	61 (11.8)	70.8 (14.1)	57.7 (12.5)	57.7 (17.3)	62.1 (22.8)
Number of children						
No children	67.3 (11.7)	69.2 (13.4)	77.6 (15.1)	67.4 (14.8)	77 (19.3)	72.9 (24.3)
1–2 children	65.5 (16)	74.7 (19.2)	71 (19.9)	68.5 (21.3)	78 (20.8)	73 (23.8)
3–5 children	61 (16.5)	66.1 (14.7)	67.6 (14.1)	64.4 (13.2)	67.5 (20.1)	66.4 (24.4)
> 5 children	60.7 (17)	66.3 (16.8)	67.1 (17.2)	64.2 (16.8)	66 (21.7)	69.6 (22.5)
Smoking status						
Smoking	61.5 (12.9)	69.7 (14.8)	65.3 (13.6)	64.9 (14)	70.4 (19.8)	70.3 (19.8)
Non-smoking	61.8 (17)	66.7 (16.1)	69 (16.6)	64.8 (15.9)	68.2 (21.3)	68.5 (24.1)
Adherence level						
Non-adherents	55.3 (15.3)	60.4 (14.9)	63.4 (15.7)	58.9 (14.8)	60.5 (19.9)	59.8 (24.9)
Adherents	69.4 (14.5)	75.1 (13.4)	74.6 (14.6)	71.9 (13.5)	77.9 (18.5)	79.4 (16.6)

Non-adherence considered when participants scored < 6 on MMAS-8, while good medication adherence was considered in those scoring 6 or above

QoL quality of life, *M* mean, *SD* standard deviation

positive association between adherence and QoL in diabetic and/or hypertensive patients has been documented previously in the literature [31, 32, 36]. However, some studies have reported a weak or negligible correlation between medication adherence and QoL in hypertensive and diabetic patients [37, 38]. This variation in findings can be attributed to differences in study populations and methods of assessing medication adherence and QoL. Poor psychometric properties of the tool used to assess medication adherence were cited as potential reason by Cote et al. for a weak correlation between medication adherence and QoL among hypertensive patients attending community pharmacies in Canada (Quebec City/Quebec) [37]. The validity and reliability of 8-item MMAS, used in the present study, among adults with hypertension and diabetes in the different population groups [39, 40], including Arabic-speaking populations have been well documented [41].

Non-adherence to medicines not only leads to disease-related complications but is also associated with an increase in hospital admission with associated higher healthcare costs [3]. It has been estimated that 10% of hospital admissions in older adults can be attributed to medication non-adherence [42], which could lead to poor disease management. Furthermore, a longitudinal cohort study estimated that a 10% increase in medication adherence can reduce annual healthcare costs by 8.6–28.9% among diabetic patients [43]. An uncontrolled disease condition has a substantial impact on patients' QoL as it may limit patients' daily activities, reduce their self-esteem, result in financial problems, and patients might become socially withdrawn [31].

Table 3 Multiple linear regression analysis of predicting variables for quality of life domains

Variables	Quality of life domains								Overall perception of QoL		Overall perception of health	
	Physical health		Psychological		Social relationship		Environment					
	β	*P*-value	β	*P*-value	B	*P*-value	β	*P*-value	β	*P*-value	β	*P*-value
Level of adherence (ref = non-adherents)	12.4	0.001	12.6	0.001	10.8	0.001	10.6	0.001	14.6	0.001	17.2	0.001
Gender (ref = male)	− 5.4	0.001	− 12.2	0.00	3.9	0.05	− 7.6	0.001	− 9.4	0.001	− 11.6	0.001
Age	− 0.15	0.02	− 0.07	0.2	0.05	0.5	0.00	0.9	− 0.05	0.6	0.08	0.4
Level of education (ref = no formal education)	0.93	0.3	1.6	0.04	2	0.03	2.3	0.001	3.6	0.001	1.7	0.2
Income status (ref = satisfied)	− 11.6	0.001	− 8.1	0.001	− 5.1	0.02	− 11.7	0.001	− 7.5	0.001	− 6.6	0.03
Marital status (ref = single)	− 0.6	0.6	1.5	0.1	2.3	0.07	− 0.6	0.5	0.03	0.9	− 0.6	0.7
Number of children (ref = no children)	− 0.4	0.6	− 0.6	0.5	− 2.4	0.02	0.1	0.9	− 2.2	0.07	− 0.06	0.9
Smoking status (ref = smoking)	5.2	0.02	3.9	0.07	4.5	0.08	5.9	0.001	5.8	0.06	4.7	0.2
R^2, Ra^2	0.33, 0.32		0.43, 0.42		0.19, 0.17		0.39, 0.38		0.33, 0.31		0.26, 0.24	

Non-adherence considered when participants scored < 6 on MMAS-8, while good medication adherence was considered in those scoring 6 or above

QoL quality of life, *β* standardised regression coefficients, *Ref* is the reference group in each category

Table 4 Two-way ANOVA test to assess interaction between disease type and medication adherence on the quality of life

Variables	Quality of life domains								Overall perception of QoL		Overall perception of health	
	Physical health		Psychological		Social relationships		Environment					
	M (SD)	*P*-value	M (SD)	*P*-value	M (SD)	*P*-value	M (SD)	*P*-value	M (SD)	*P*-value	M (SD)	*P*-value
Level of adherence												
Non-adherent	55.3 (15.3)	0.001	60.4 (14.9)	0.001	63.4 (15.7)	0.001	58.9 (14.8)	0.001	60.5 (19.9)	0.001	59.8 (24.9)	0.001
Adherent	69.4 (14.5)		75.1 (13.4)		74.6 (14.6)		71.9 (13.5)		77.9 (18.5)		79.4 (16.6)	
Type of disease												
DM	63 (15.7)	0.38	68.6 (17.2)	0.29	64.3 (15.2)	0.001	66 (15.1)	0.36	68.7 (20.6)	0.93	67.7 (21.6)	0.9
HTN	64.3 (14.4)		67.1 (15.8)		74.5 (15.5)		64.2 (15.7)		69.8 (20.8)		71.6 (22.7)	
Both	59.9 (17.6)		66.2 (15.3)		68.9 (16.4)		64.4 (15.9)		67.9 (21.6)		68.3 (25)	
Interaction	–	0.96	–	0.86	–	0.94	–	0.63	–	0.88	–	0.60
R^2, R^2_a	0.188, 0.174		0.218, 0.204		0.157, 0.142		0.183, 0.169		0.170, 0.156		0.175, 0.161	

Non-adherence considered when participants scored < 6 on MMAS-8, while good medication adherence was considered in those scoring 6 or above

QoL quality of life, *M* mean, *SD* standard deviation, *DM* diabetes mellitus, *HTN* hypertension

In our study, male patients had better QoL compared to female patients after adjusting for other covariates. Low levels of medication adherence have been previously documented among Saudi women [15, 23], which may partly explain poorer QoL among women compared to men in this study as medication adherence is an independent predictor of QoL. Other factors, identified in the literature, which may contribute to poorer QoL among women include societal dominance of men, higher educational level of men, higher psychological and physical stress among women, and unmet basic needs of women [44].

Not surprisingly, patients with any sort of formal education had better QoL compared to patients with no formal education in the present study. Educated patients might have better social support, self-esteem, and a thorough understanding of their medications, disease condition, and related complications [38], which would promote medication adherence and subsequently would result in better QoL [45].

In line with the findings of our study, studies conducted among diabetic patients have reported that educated patients had significantly better scores across all QoL domains [38, 46]. However, another study found no significant association between education level and QoL [37]. The differences in results may be attributed to the differences in types of medications used, sample size, population demographics, chronicity, and severity of disease or lag time between the study datasets.

Practice implications

The present study has significant clinical implications both in local and international context. Locally, poor QoL and high prevalence of non-adherence to medications among primary care patients with diabetes and/or hypertension is alarming. Given that medication adherence may have significant impact on patients' QoL and clinical outcomes, PCPs should emphasise the importance of adherence to patients during initial consultations and reinforce it in the follow-up consultations; rule out non-adherence among patients with uncontrolled diabetes or hypertension before titrating up or adding on a drug; and engage patients in disease management decision-making using a concordant approach. Internationally, the present study adds to existing body of literature on medication adherence and has reinforced seriousness of the problem, non-adherence, among patients with diabetes and/or hypertension. This calls for further research into medication adherence, identifying barriers to adherence among different socioeconomic classes, strategies to improve medication adherence, and role of healthcare professionals in improving patient adherence. Medicines belonging to different pharmacological classes can have a potentially significant impact on patients' QoL [47–49], however, some studies do not support this finding [50, 51]. Considering the impact of different medications on patients' overall QoL, the prescribing competence of physicians should be reassured with the consideration of the best drug choice and simpler dosing regimen that are likely to produce better QoL outcomes [32, 52]. In addition, improving patients' adherence to their medications is likely to improve medication safety resulting in fewer medication errors and better clinical outcomes, subsequently enhancing their QoL [32].

Limitations

The current study had some limitations. Recall bias is frequently associated with self-reported measures. Therefore, the use of self-reported questionnaires in the present study might have misestimated the true incidence of patients' adherence and subsequently its association with the QoL. In addition, volunteer bias may also be present since our sample consisted of 'volunteers'. Notably, our analyses were not adjusted for disease characteristics (e.g. severity, duration of illness and presence of any complications) and treatment modalities as such data were not available to authors. Severity and duration of chronic diseases and the presence of disease-related complications have been shown to have a negative impact on patients' QoL. However, our aim was to study the association between medication adherence and QoL only. Furthermore, since this was a cross-sectional study, the direction of association (whether poor medication adherence leads to poor QoL or poor QoL leads to poor medication adherence) cannot be ascertained. Finally, the study included Arabic-speaking population only and used the Arabic version of the MMAS-8. Thus, the results cannot be generalised to the non-Arabic-speaking population living in Saudi Arabia.

Conclusion

Medication adherence is an independent predictor of QoL among patients with diabetes and/or hypertension attending primary care clinics in Makkah, Saudi Arabia. Adherent patients are likely to enjoy a better QoL and overall health compared to non-adherent patients. Gender, income status, and education level were other significant predictors of QoL found in our study. It is critical for healthcare professionals engaged in providing care to patients with diabetes and/or hypertension to involve patients in decision-making process and promote medication adherence during routine clinical consultations. Future research should explore barriers to medication adherence among Saudi patients and identify interventions likely to improve medication adherence among patients in primary care.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval Ethics approval was obtained from the Institutional Review Board (IRB) at the Faculty of Pharmacy, Umm Al-Qura University, Makkah, Saudi Arabia. In addition, ethics and governance approval were also sought from the General Directorate of Health Affairs of Makkah Region, Ministry of Health, Saudi Arabia (Ref # M/47/402/2,646,280).

Informed consent All patients completed written consent form prior to enrolment in the study.

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