

# Quality of Life of Adult Patients with Type 2 Diabetes Mellitus in Kuwait: A Cross-Sectional Study

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## Highlights of the Study

- Diabetes mellitus type 2 is a public health issue in Kuwait due to the high prevalence rate.
- Healthcare providers should pay attention to the quality of life (QoL) among patients with diabetes.
- This study identified the factors associated with poor outcomes of QoL, including the health region in Kuwait, type of treatment, educational level, marital status, and BMI.
- This will enable patients to better control diabetes and sustain health and well-being.

## Keywords

Quality of life · Type 2 diabetes · Kuwait · Public health

## Abstract

**Objectives:** The aim of this study was to evaluate the Quality of Life (QoL) of Kuwaiti patients with Type 2 Diabetes Mellitus (T2DM), aged  $\geq 45$  years of both genders, and identifying factors associated with poor QoL. **Methods:** This cross-sectional study was conducted on a random sample stratified by gender, consisting of 604 Kuwaiti patients with T2DM, aged  $\geq 45$  years, diagnosed as diabetics for  $\geq 6$  months. A validated demographic and WHOQOL-BREF questionnaire was used to assess the QoL. **Results:** Both genders were equally represented; 46% of patients were 56–65 years of age. Only 24% of the participants had intermediate school education, while 57% were retired, and 54% of the study population had incomes of  $>1,000$  Kuwaiti dinars (KD) (USD 3,300)/month.

Most patients (76%) were married, and 99% were living with their families. Obesity was reported in 54%, and 16% were smokers. Only oral antidiabetic drugs were used by 50% of patients, while 24% of patients had complications, and 11% of them developed retinopathy. A family history of diabetes was reported in 74% of patients, and 45% of them have a duration of diabetes  $>10$  years. The median score of QoL was 71, and around 77% of the sample has a good QoL. **Conclusion:** Kuwaiti patients with T2DM aged  $\geq 45$  years reported an overall good level of QoL with higher scores in psychological and social relationships than physical and environmental domains of QoL. Health region, type of treatment, educational level, marital status, and BMI level were statistically significant predictors of poor QoL. More public health action is required to control the disease and improve the QoL.

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## Introduction

Diabetes mellitus (DM) is a widely prevalent chronic noncommunicable disease, which increased dramatically during the past few decades secondary to the lifestyle changes, causing an increased prevalence of type 2 DM (T2DM) [1]. T2DM commonly affects adults, accounting for 90% of all cases of DM [2]. The World Health Organization (WHO) estimated that DM was the seventh leading cause of mortality in 2016 [3]. In the Middle East and North Africa region, 55 million patients had T2DM in 2019, with a prevalence of 12.2%, estimated to grow to 108 million by 2045, with a prevalence of 13.9% [4]. Thus, T2DM is a serious public health concern as it leads to a high social, mental, financial, and treatment burden on patients, their families, healthcare providers, and the society as a whole [2].

Healthcare providers must focus on the psychosocial aspects of patients with T2DM just as they focus on their medical treatment as these aspects have a direct impact on their Quality of Life (QoL), leading to a better outcome. QoL is defined as “a person’s perception of their position in life in the context of the culture and value system in which they live and in relation to their expectations, concerns, goals, and standards” [5]. DM can cause both short-term and long-term consequences, affecting different organs and parts of the body, leading to premature death [6]. Such complications may negatively affect the QoL of patients and their families [7]. A comprehensive approach to the management of diabetes should rely on the assessment of the disease based on laboratory tests, as well as the different aspects of patients’ QoL [8].

In Kuwait, the population aging is increasing, so the number of adults with T2DM is expected to increase accordingly, and such a scenario requests improving the disease management [9]. In 2020, the prevalence of DM among adults in Kuwait was 22% (681,000/3,096,400) [10]. In the USA, the primary purpose is to improve the patients’ QoL, which is an essential outcome for all medical interventions in diabetic patients [11]. In Kuwait, QoL is considered as a vital tool that can help to predict the capacity of the patient to control diabetes, prevent or treat its complications, and sustain long-term health and well-being.

There is a dearth of research regarding the QoL of patients with T2DM in Kuwait [12]. Inappropriate control of diabetes and overall patient’s health status is associated with impaired QoL and poor self-management [13]. This research aimed to assess the QoL among Kuwaitis

with T2DM aged  $\geq 45$  years and to identify factors which may have a significant association with poor QoL of the patients.

## Methods

### *Study Design and Study Population*

A multistage sampling was used by random selection of 14 primary healthcare centers in Kuwait, based on the proportional distribution of the population density of Kuwaiti adults aged  $\geq 45$  years in each health region. A random stratified sample of 604 Kuwaiti patients with T2DM was chosen, of both genders aged  $\geq 45$  years, who have been diagnosed as diabetics by physicians for  $\geq 6$  months, who attended the selected health centers between June and September 2019. The exclusion criteria included the non-Kuwaiti patients, patients having type 1 DM or gestational diabetes, severely ill patients, and those  $< 45$  years of age. After signing informed consent, the patients were given the self-administered validated questionnaire, and their weight and height were measured by a well-trained nurse. Relevant data were taken from the patients’ files. Monthly income was divided into lower class ( $< 500$  Kuwaiti dinars (KD)/month), middle class (500–1,000 KD/month), and upper class ( $> 1,000$  KD/month).

### *Ethical Considerations*

The study was approved by the Ministry of Health (MOH) Ethical Committee (no. 1094/2019). Details about the study were provided to participants before signing the consent forms; they were informed that withdrawal from the study would not have negative consequences, that participating in it does not provide any benefit, and that the data would be used for scientific purposes only with strict confidentiality.

### *The Study Tool*

A validated and reliable self-report questionnaire in both Arabic and English was used to estimate QoL and the related factors among Kuwaiti adults with T2DM. The questionnaire included three sections: sociodemographic (8 questions) and clinical characteristics (5 questions) and a WHO self-report questionnaire (WHOQOL-BREF) (26 questions) related to generic measurement of QoL, scored on a 5-point scale. The last has four domains of QoL: physical health (PHH) (7 questions), psychological health (PSH) (6 questions), social relationships (SR) (3 questions), and environment health (EH) (8 questions), added to the individual’s overall perception of the QoL and health (2 questions). The mean score of items within each domain was used to calculate the domain score. Mean scores were then multiplied by 4 to make domain scores comparable with the scores used in the WHOQOL-100. The first transformation method converts scores to range between 4 and 20, comparable with the WHOQOL-100. The second transformation converts domain scores to a 0–100 scale [14]. The overall QoL is the average of the four domain scores [11], and then, the scores were divided into groups according to the median. Patients with scores  $\leq$  the median score were classified as “poor” and scored “1,” while patients with scores  $>$  the median score were classified as “good” and scored “0” [12]. The four QoL domains were categorized as the total QoL. A lower score means poor QoL.

**Table 1.** Demographic characteristics of Kuwaiti T2DM patients ( $n = 604$ ), 2019

Characteristics	Frequency	
	$n$ (604)	(%)
HR		
Al-Asima	144	(23.8)
Hawally	120	(19.9)
Al-Ahmadi	176	(29.1)
Al-Farwaniyah	96	(15.9)
Al-Jahra	68	(11.3)
Gender		
Male	302	(50.0)
Female	302	(50.0)
Age, years		
45–55	227	(37.6)
56–65	278	(46.0)
66–75	84	(13.9)
>75	15	(2.5)
Educational level		
Postgraduate	21	(3.5)
University	112	(18.5)
Diploma	122	(20.2)
High school	146	(24.2)
Intermediate school	126	(20.9)
Primary school	23	(3.8)
No education	54	(8.9)
Work status		
Employed	114	(18.9)
Retired	342	(56.6)
Not employed	148	(24.5)
Marital status		
Single	18	(3.0)
Married	459	(76.0)
Divorced	47	(7.8)
Widowed	80	(13.2)
Income, KD/month		
>1,000	324	(53.6)
500–1,000	233	(38.6)
<500	47	(7.8)
Residential status		
With family	599	(99.2)
Alone	5	(0.8)
Smoking		
Yes	96	(15.9)
No	508	(84.1)

### Statistical Methods

Sociodemographic and clinical variables were defined as independent variables, while the overall QoL and its four domains were defined as dependent variables (outcome). SPSS was used for data analysis; the descriptive data were expressed for categorical variables. The normality of distribution of each domain and overall QoL was examined using the Shapiro-Wilk test. It was applied to investigate the association between independent variables and the levels of total QoL and each of the four domains by using the likelihood and Pearson  $\chi^2$  tests in the univariate analysis, with  $\leq 0.1$  as

**Table 2.** Clinical characteristics of Kuwaiti T2DM patients ( $N = 604$ ), 2019

Characteristics	Frequency	
	$n$ (604)	(%)
BMI, kg/m <sup>2</sup>		
Normal (<25)	49	(8.1)
Overweight (25.0–29.9)	227	(37.6)
Obese ( $\geq 30.0$ )	328	(54.3)
Family history of diabetes		
Yes	446	(73.8)
No	158	(26.2)
Duration of diabetes, years		
<5	155	(25.7)
5–10	177	(29.3)
>10	272	(45.0)
Levels of HbA1c, %		
Good (<7)	176	(33.7)
Moderate (7–8.99)	236	(45.2)
Poor ( $\geq 9$ )	110	(21.1)
Type of treatment		
1 treatment	400	(66.2)
Insulin only	90	(14.9)
Diet only	6	(1.0)
Physical exercise only	2	(0.3)
Oral antidiabetic drugs only	302	(50)
2 treatments	170	(28.1)
$\geq 3$ treatments	34	(5.6)
Type of complications		
No complications	460	(76.2)
With complications	144	(23.8)
1 complication	107	(17.7)
Retinopathy only	69	(11.4)
Neuropathy only	17	(2.8)
Nephropathy only	3	(0.5)
Diabetic foot only	18	(3.0)
2 complications	28	(4.6)
$\geq 3$ complications	9	(1.5)

the significant level because some variables might be potential confounders but statistically not significant. The binomial regression was used in the multivariable analysis to investigate the association between un-excluded independent variables with poor QoL and each of its four domains. A  $p$  value  $\leq 0.05$  was considered as significant in the regression.

### Results

#### *Sociodemographic and Clinical Characteristics of the Patients (Tables 1, 2)*

The sample included equal numbers of both genders ( $n = 302$  each); the largest number of patients was from the Al-Ahmadi region (176, 29.1%), and the lowest number was from Al-Jahra (68, 11.3%). The largest number of

**Table 3.** Logistic regression of significant factors associated with a poor physical domain of QoL, Kuwait, 2019

Characteristics	Subgroups <i>n</i>	Crude OR of poor PHH			AOR of poor PHH*		
		OR	[95% CI]	<i>p</i> value	OR	[95% CI]	<i>p</i> value
HR	604	1.3	[1.2–1.5]	0.001**	1.4	[1.2–1.6]	0.001**
Al-Ahmadi	176	1.0	[Reference]		1.0	[Reference]	
Al-Asima	144	0.4	[0.2–0.8]	0.013**	0.4	[0.2–0.8]	0.007**
Hawally	120	0.4	[0.2–0.8]	0.010**	0.4	[0.2–0.8]	0.006**
Al-Jahra	68	1.3	[0.7–2.3]	0.377	1.2	[0.7–2.2]	0.508
Al-Farwaniyah	96	1.6	[0.8–2.9]	0.178	1.5	[0.8–2.8]	0.263

OR, odds ratio. \* Adjusted to gender, age, and HR. \*\* Significant factors at the 5% significance level.

**Table 4.** Logistic regression of significant factors associated with a poor psychological domain of QoL, Kuwait, 2019

Characteristics	Subgroups <i>n</i>	Crude OR of poor PSH			AOR of poor PSH*		
		OR	[95% CI]	<i>p</i> value	OR	[95% CI]	<i>p</i> value
HR	604	1.1	[1.0–1.3]	0.027**	1.1	[1.0–1.3]	0.010**
Al-Ahmadi	176	1.0	[Reference]		1.0	[Reference]	
Al-Asima	144	1.1	[0.6–2.1]	0.673	1.0	[0.6–1.8]	0.897
Hawally	120	1.1	[0.6–2.0]	0.871	1.0	[0.5–1.8]	0.816
Al-Jahra	68	2.6	[1.4–4.6]	0.002**	2.3	[1.3–4.3]	0.007**
Al-Farwaniyah	96	2.9	[1.5–5.5]	0.001**	2.6	[1.3–5.0]	0.007**
BMI level	604	0.6	[0.5–0.8]	0.005**	0.6	[0.5–0.8]	0.002**
Normal	49	1.0	[Reference]		1.0	[Reference]	
Obese	328	0.4	[0.2–0.7]	0.005**	0.3	[0.1–0.7]	0.003**
Overweight	227	0.5	[0.2–0.9]	0.049**	0.5	[0.2–0.9]	0.036**
Type of treatment	604	0.8	[0.7–0.9]	0.003**	0.8	[0.7–0.9]	0.001**
≥3 treatments	34	1.0	[Reference]		1.0	[Reference]	
1 treatment only	400						
Physical exercises	2	1.8	[0.8–4.0]	0.143	1.4	[0.2–8.4]	0.735
Diet	6	2.5	[0.4–15.8]	0.319	0.3	[0.0–4.6]	0.352
Oral antidiabetic drugs	302	1.3	[0.1–22.0]	0.871	0.6	[0.3–1.0]	0.033**
Insulin	90	1.0	[0.5–2.1]	0.919	0.4	[0.2–0.7]	0.003**
2 treatments	170	0.8	[0.4–1.7]	0.565	0.5	[0.2–1.1]	0.092

OR, odds ratio. \* Adjusted to gender, age, HR, BMI level, and treatment type. \*\* Significant factors at the 5% significance level.

patients (278, 46%) was in the class of 56–65 years of age, and around one-fourth of them ( $n = 146$ , 24.2%) completed high school, and one-fourth were not employed. The majority of patients were married ( $n = 459$ , 76%), lived with their families ( $n = 599$ , 99.2%), earned >1,000 KD/month ( $n = 324$ , 53.6%), and were nonsmokers ( $n = 508$ , 84.1%). The minority of patients had normal BMI ( $n = 49$ , 8.1%). Around three-quarters had positive family history of diabetes ( $n = 446$ , 73.8%), and 45% ( $n = 272$ ) had diabetes for >10 years. Nearly half of the sample ( $n = 236$ , 45.2%) had a moderate hemoglobin A1c level (7–

8.99%), and another half were using oral antidiabetic drugs ( $n = 302$ ), followed by insulin ( $n = 90$ , 14.9%). Around two-thirds of patients (400, 66.2%) had only a single type of treatment, while 170 (28.1%) had 2 types of treatment. Complications reported in one-quarter of the respondents ( $n = 144$ , 23.8), and retinopathy was the commonest (69/604, 11.4%).

#### QoL and Its Domains

The median score and interquartile range (IQR) for the QoL and its four domains in this study are as follows:

**Table 5.** Logistic regression of significant factors associated with a poor social relationships domain of QoL, Kuwait, 2019

Characteristics	Subgroups	Crude OR of poor SR			AOR of poor SR*		
	<i>n</i>	OR	[95% CI]	<i>p</i> value	OR	[95% CI]	<i>p</i> value
Marital status	604	0.7	[0.6–0.9]	0.018**	0.7	[0.5–0.9]	0.024**
Married	459	1.0	[Reference]		1.0	[Reference]	
Single	18	1.3	[0.5–3.8]	0.586	1.2	[0.4–3.7]	0.697
Divorced	47	1.7	[1.1–2.8]	0.027**	1.8	[1.0–3.1]	0.034**
Widowed	80	0.9	[0.4–2.0]	0.881	0.9	[0.4–2.0]	0.825
Educational level	604	0.8	[0.76–0.9]	0.018**	0.8	[0.7–0.9]	0.023**
No education	54	1.0	[Reference]		1.0	[Reference]	
Postgraduate	21	0.7	[0.3–2.0]	0.521	0.7	[0.3–1.9]	0.530
University	112	1.9	[1.0–3.7]	0.049**	2.2	[1.4–3.5]	0.001**
Diploma	122	1.1	[0.6–2.1]	0.724	1.3	[0.8–2.1]	0.249
High school	146	0.9	[0.5–1.8]	0.891	1.1	[0.7–2.0]	0.496
Secondary school	126	0.8	[0.4–1.5]	0.532	1.0	[0.5–1.8]	0.917
Primary school	23	0.6	[0.2–1.7]	0.352	0.6	[0.2–1.6]	0.263

OR, odds ratio. \* Adjusted to age, gender, marital status, and educational level. \*\* Significant factors at the 5% significance level.

**Table 6.** Logistic regression of significant demographic and clinical factors associated with a poor environment domain of QoL, Kuwait, 2019

Characteristics	Subgroups	Crude OR of poor EH			AOR of poor EH*		
	<i>n</i>	OR	[95% CI]	<i>p</i> value	OR	[95% CI]	<i>p</i> value
HR	604	1.3	[1.1–1.5]	0.001**	1.3	[1.1–1.5]	0.001**
Al-Ahmadi	176	1.0	[Reference]		1.0	[Reference]	
Al-Asima	144	0.6	[0.3–1.2]	0.161	0.6	[0.3–1.1]	0.111
Hawally	120	1.9	[0.7–2.5]	0.455	1.2	[0.6–2.4]	0.530
Al-Jahra	68	2.7	[1.4–5.0]	0.002**	2.4	[1.3–4.6]	0.005**
Al-Farwaniyah	96	3.7	[1.9–7.3]	0.001**	3.4	[1.7–6.8]	0.001**

OR, odds ratio. \* Adjusted to age, gender, and HR. \*\* Significant factors at the 5% significance level.

PHH (64.3, IQR = 21.4), PSH (75.0, IQR = 20.8), SR (75.0, IQR = 16.6), EH (71.9, IQR = 21.9), and the overall QoL (71.3, IQR = 14.04). Among all levels, both PSH and SR had the highest median score, followed by EH and PHH domains, respectively.

#### *Multivariate Analysis of Significant Factors Correlated with QoL and Its Domains*

The significant factors associated with poor QoL and its four domains among Kuwaiti adult patients with T2DM are presented in (Tables 3–7). The regression analysis showed that patients in Al-Asima and Hawally health regions (HRs) were less likely to report poor PHH than patients in Al-Ahmadi HR (adjusted odds ratio

[AOR] 0.4;  $p = 0.007$ ; 0.4;  $p = 0.006$ , respectively) (Table 3). Concerning PSH, the multivariate analysis found that patients in Al-Jahra HR had 2.3 times higher odds of reporting poor PSH of QoL than patients in Al-Ahmadi HR ( $p = 0.007$ ). Also, patients in Al-Farwaniyah HR were more likely to report a poor PSH than those in Al-Ahmadi (AOR, 2.6;  $p = 0.007$ ). Furthermore, overweight or obese patients are less likely to report a poor PSH compared to patients with a normal BMI (AOR, 0.5;  $p = 0.036$  and AOR, 0.3;  $p = 0.003$ , respectively). Patients having only one treatment were less likely to report poor PSH compared to those with  $\geq 3$  treatments (AOR, 0.6;  $p = 0.033$  and AOR, 0.4;  $p = 0.003$ , respectively) (Table 4). In the SR domain, divorced patients and those with a uni-

**Table 7.** Logistic regression of significant factors associated with poor overall QoL, Kuwait, 2019

Characteristics	Subgroups	Crude OR of poor QoL			AOR of poor QoL*		
	<i>n</i>	OR	[95% CI]	<i>p</i> value	OR	[95% CI]	<i>p</i> value
HR	604	2.1	[1.8–2.5]	0.001**	2.2	[1.8–2.7]	0.001**
Al-Ahmadi	176	1.0	[Reference]		1.0	[Reference]	
Al-Asima	144	–**	–***	0.995	–***	–***	0.995
Hawally	120	–***	–***	0.996	–***	–***	0.995
Al-Jahra	68	1.8	[1.0–3.3]	0.062	1.6	[0.9–3.1]	0.139
Al-Farwaniyah	96	2.5	[1.3–4.8]	0.007**	2.2	[1.1–4.5]	0.023**

OR, odds ratio. \* Adjusted to gender, age, and HR. \*\* Significant factors at the 5% significance level. \*\*\* HRs with only one outcome.

versity certificate were more likely to report poor SR compared to those who were married and those with no education (AOR, 1.8;  $p = 0.034$  and AOR, 2.2;  $p = 0.001$ , respectively) (Table 5). Regarding the EH domain, Kuwaiti patients with T2DM who lived in Al-Jahra and Al-Farwaniyah were more likely to report poor EH compared to those living in Al-Ahmadi HR (AOR, 2.4;  $p = 0.005$  and AOR, 3.4;  $p = 0.001$ , respectively) (Table 6). Finally, after adjustment for potential confounders, we found that Kuwaiti patients with T2DM who lived in Al-Farwaniyah HR had 2.2 times higher odds of reporting poor QoL than patients in Al-Ahmadi HR ( $p = 0.023$ ). All patients in both Al-Asima and Hawally HRs had only one outcome (good QoL) (Table 7).

## Discussion

This cross-sectional study was aimed at assessing the QoL and its four domains among Kuwaiti patients with T2DM, aged  $\geq 45$  years, who were attending primary healthcare centers in the five HRs in Kuwait. The main result showed that patients had a good level of overall QoL, which is in accord with other studies [15]. This result could be attributed to the high-income of the country, which provides all facilities that make life easy and enjoyable [16]. However, this result contradicts a study conducted in Saudi Arabia [17]. Such differences can be attributed to the types of methodology adopted as the used tools, the cutoff points, and probably other factors.

The lowest median score in this study was found in the PHH, and similar results were reported in studies conducted in the United Arab Emirates and Ethiopia [11, 16]. This finding can be attributed to the nature of DM, which

shows more manifestation in the physical domain than other domains of QoL [11]. On the other hand, the highest median score was obtained in both PSH and SR, and such findings were in accord with the studies conducted in Brazil [18] and in the United Arab Emirates [16]. Such differences can be attributed to sociocultural and lifestyle variations of different societies [11]. Our study's finding implies that Kuwaiti patients with T2DM are psychologically balanced and are satisfied with family bonding, personal relationships, and social support. This may be attributed to the lifestyle in Kuwaitis and the traditions, norms, and trends that may provide social support and inclusion.

The HR was associated with the physical domain of QoL as the patients living in Al-Asima and Hawally HRs were less likely to have lower PHH compared to patients in Al-Ahmadi HR. It is possible that patients in Al-Ahmadi HR are less active physically due to their bad health status and lack of awareness about proper lifestyle behaviors, the limited number of health clubs, walking areas, and parks, compared to those living in Hawally and Al-Asima HRs. This illustrates the impact of the poor design of the physical surroundings that could promote the adoption of unhealthy lifestyle behavior [19]. Moreover, patients in Al-Ahmadi HR are probably in need of education on lifestyle management to control diabetes. Availability of non-pharmacological approaches in primary healthcare centers is necessary for lifestyle modification to improve disease management [20].

Lower levels of the psychological domain of QoL were found among T2DM patients living in Al-Jahra and Al-Farwaniyah HRs than in patients in the Al-Ahmadi HR, which can be caused either by internal factors, such as negative emotions, low self-esteem, and cognitive problems, or by external factors, such as the lack of psycho-

logical support and proper medical treatment in their health centers. Our results were expected because there is a shortage of information on diabetic patients in primary care settings in Kuwait which are taking care of such patients [21]. Also, the study found that patients taking  $\geq 3$  treatments are more likely to report poor PSH than those using only one treatment, probably because of the severity of the disease and the presence of complication that require multiple treatments, and also the possibility of drugs interactions. Such a scenario of an intensive treatment leads to lower QoL by creating negative emotions [11].

Significantly, patients who are overweight or obese are less likely to report a lower PSH compared to patients with normal BMI. The normal BMI might be maintained by the disease itself, its complications, the associated negative emotions, or by adopting strict healthy lifestyle behaviors, such as severe continuous diet and practicing vigorous physical exercise [22, 23], which could probably create a high level of stress, especially in this age-group ( $\geq 45$  years). This result is in accord with a Japanese study, showing that changing the lifestyle of diabetic patients leads to an increased risk of having lower scores of general health and both emotional and physical role scores [24].

Regarding the SR domain, this study showed poor social relationship among divorced patients when compared with married ones. This can be explained by the absence of social support and inclusion provided by the spouse hence lacking close personal relationships; thus, the loss of the spouse can deteriorate the QoL of diabetic patients [18, 24]. Also, poor SR were found among patients with university education compared to the noneducated ones [25]. This may be explained by excessive occupational commitments of the patients with high education, which limit the time for socialization. In the environmental domain, the participants in Al-Jahra and Al-Farwaniyah regions reported poor EH compared to Al-Ahmadi health region. This is probably caused by the patients' lower satisfaction with the relatively less developed environment in their areas, in addition to the high level of violence, precarious and unpaved roads [18], noise, air pollution, overcrowding, and traffic accidents.

Finally, for the overall QoL, the regression analysis showed that the patients living in the Al-Farwaniyah health region reported poor QoL compared to patients in the Al-Ahmadi health region. Patients in the Al-Farwaniyah health region reported poor environmental and psychological health, also lower quality of healthcare services compared with other regions, and of sociodemographic

characteristics of patients, such as educational and income levels, and finally, the limited awareness about the disease.

The strengths of the study arise from it being the first study in Kuwait dealing with T2DM with multiple outcomes and exposures; this can help healthcare policy makers adopt holistic management approaches to improve the outcome. Also, the random large sample may represent the Kuwaiti T2DM population in Kuwait, and the help of a well-trained nurse for data collection and BMI calculations prevented interpersonal bias; the adherence to the protocol guidelines and the use of an international validated and reliable questionnaire. However, the limitations of the study might stem from problems in patients' recall or giving unrealistic replies to avoid social stigma or to get the researchers' approval. Some illiterate patients were helped by researchers who read the questionnaire to them; this may have created a bias in their responses. Also, the refusal of some patients to participate and the noninclusion of severely ill patients might be additional limitations. Finally, the lack of some clinical information in the patient's files and the noninvolvement of concomitant medication and the comorbidities in the regression analysis were other limiting factors.

## Conclusion

T2DM requires life-long medical treatment and lifestyle modifications. The rising trend of its prevalence creates a public health issue, with heavy burdens on patients, families, and the healthcare system. Hence, the effects of T2DM on clinical, social, financial, and psychological aspects are substantial. Most patients in this study (92%) have obesity/overweight, and 2% practice regular exercise, which necessitates better health literacy in the management of diabetes, extending to different domains in patients' QoL. Adults with T2DM ( $\geq 45$  years) reported an overall good level of QoL with higher scores in psychological and social relationships of QoL. The HR is found to be the only predictor of poor PHH, while HR, BMI level, and type of treatment are predictors of poor PSH. Also, both educational level and marital status are associated significantly with poor SR domain, and the HR is the only variable that is related significantly to poor EH and poor overall QoL. The study provides essential information about the QoL and the health status of T2DM patients. The patients' QoL may be improved by proper communication, provision of health literacy including education on healthy behavior, and dealing with the negative factors affecting QoL.

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## Statement of Ethics

The study was approved by the MOH Ethical Committee (no. 1094/2019). Full details about the study were given to participants before signing the written consent forms. They were informed that withdrawal from the study at any time without negative consequences; there was no benefit in their enrollment, and the data will be used with strict confidentiality and for scientific purpose only.

## Conflict of Interest Statement

There is nothing to declare in this section, as there was no conflict of interest.

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## Author Contributions

J.A. designed and carried out the study, analyzed the data, and drafted the manuscript. M.A. contributed to study design, supervised its conduction through all the stages, and revised the manuscript. Both the authors read and approved the final manuscript.

## Data Availability Statement

All data generated or analyzed during this study are included in this article. Further inquiries can be directed to the corresponding author M.S.