ORIGINAL RESEARCH

Exploring Health-Related Quality of Life and Correlates Among Patients with Type 2 Diabetes Mellitus Attending Primary Health Centers in Aljouf Province, Saudi Arabia: A Multi-Site Cross-Sectional Study

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Purpose: Type 2 diabetes mellitus (T2DM) impacts various elements of health-related quality of life (HRQoL). However, research on the HRQoL of T2DM patients in primary healthcare settings in Saudi Arabia is limited. Therefore, we aimed to determine the HRQoL and associated factors among patients with T2DM to plan policy-driven interventions and improve patient outcomes.

Participants and Methods: We surveyed 390 patients with T2DM attending primary health centers (PHCs) in the Aljouf province of Saudi Arabia. We included Saudi adults (≥18 years) diagnosed at least six months before the study and completed at least one follow-up visit at the PHC. In the present cross-sectional study, we used the validated 20-item short-form health survey (SF-20)-Arabic tool to assess different HRQoL domains. We performed Mann–Whitney U and Kruskal–Wallis tests for dichotomous and categorical variables, respectively, in each domain. Finally, a binomial logistic regression analysis was performed to determine the predictors of overall HRQoL.

Results: The role functioning domain had the highest mean score (75.7±19.7), and the lowest scores were in the social functioning (47.9±20.2) and pain domains (48.9±21.4). Some characteristics, such as marital status, treatment type, and follow-up adherence, were significantly associated with most domains. HRQoL was significantly higher in male patients (p=0.002, adjusted odds ratio [AOR] =2.66) and those on oral hypoglycemic agents (OHAs; p=0.002, AOR=5.18). Obese patients had a significantly lower HRQoL (p=0.036, AOR=0.058). These factors remained significant after adjusting for age, sex, body mass index, treatment type, and comorbidities in the multivariate analysis.

Conclusion: We recommend policy changes that incorporate interventions tailored to improve HRQoL, especially in social functioning and pain domains. Moreover, integrating comprehensive pain management strategies and enhancing patient follow-up within PHCs may improve quality of life, especially for high-risk patients with T2DM.

Keywords: diabetes mellitus, primary healthcare, quality of life, T2DM patients, SF-20, pain management

Introduction

Diabetes mellitus, particularly type 2 diabetes mellitus (T2DM), is a critical global health problem with increasing prevalence and a substantial healthcare system burden. Globally, T2DM is the most common form of diabetes,

accounting for approximately 90% of diabetes cases.[1–3] According to the World Health Organization (WHO), approximately 830 million individuals globally have diabetes, and diabetes directly causes 1.6 million deaths yearly.[4] The prevalence rate of diabetes, especially T2DM, is very high in the Kingdom of Saudi Arabia (KSA), and KSA has one of the highest T2DM prevalence rates. According to the International Diabetes Federation (IDF), Saudi Arabia has an adult diabetes prevalence rate of 17.7%, affecting approximately 4,274,100 individuals.[5] This high T2DM prevalence results from rapid urbanization, Western lifestyle adoption, genetic predisposition, and changes in dietary habits, especially among the young population.[3,6–8] Complications of T2DM include cardiovascular diseases, neuropathy, retinopathy, and nephropathy, and they worsen disability and mortality rates. In social terms, diabetes reduces productivity, limits activities of daily living, and affects mental health.[9,10] Hence, a multi-pronged approach to reduce its effects, including prevention, early detection, patient education, lifestyle adjustments, and equitable healthcare, is required.[9,11]

Quality of life (QoL) is a multidimensional construct that uses a comprehensive approach to measure patients' subjective well-being in different areas, including physical health, psychological state, social relations, and environmental factors[12] Maintaining a good health-related quality of life (HRQoL) is essential in chronic conditions such as T2DM.[13,14] HRQoL is focused on the impact of a disease and its treatment on an individual's perception of health and general quality of life. T2DM severely affects the HRQoL because it is a chronic disease affecting multiple outcomes.

Wonde et al in 2022 demonstrated that approximately half of their study participants (patients with T2DM) had good HRQoL, and male sex, regular physical activity, and absence of complications were positively associated with HRQoL.[15] Interestingly, Al-Shehri et al found that female patients had lower HRQoL than males.[16] Lu et al conducted an HRQoL assessment survey in East China. They reported that patients with diabetes had lower HRQoL domain scores, significantly associated with age, sex, education status, and regional economic condition.[17] Some authors assessed HRQoL among patients with T2DM using the EQ-5D, the WHOQOL-BREF, and the SF-36.[18–20] These studies on the HRQoL of patients with T2DM were mainly performed in hospital settings or limited geographical regions using questionnaires that may not be applicable in primary care practice. The 20-item short-form health survey (SF-20) provides healthcare professionals with a validated, less time-consuming, and brief tool for measuring key HRQoL domains with reduced respondent time burden.[19] AbuAlhommos et al surveyed adult patients with T2DM (≥ 18 years) in KSA using the EQ-5D-5L tool. This study was conducted at the Diabetic Centre at King Fahad Hospital and Prince Saud Bin Jalawy Hospital in the Al-Ahsa region of KSA. They reported that pain, mobility, and mental health were the commonly affected domains. Furthermore, their analysis found that being between 26 and 40 years old, being married, having a family history, and having good medication adherence were positively associated with a good quality of life.[19]

The available literature indicates that HRQoL varies across countries and regions.[15,18,21,22] Conducting this study in the KSA is justifiable and brings several potential advantages that could promote our knowledge of HRQoL among patients with T2DM. First, the KSA has significant geographical, cultural, and socioeconomic diversity across its regions, which can affect the prevalence, risk factors, and outcomes of T2DM. Furthermore, predictors of HRQoL change over time. Globally, including in the KSA, primary health centers (PHCs) are the cornerstone of treating and following several chronic diseases, including T2DM. Therefore, it is essential to conduct the study in primary care settings. Additionally, continuous assessment of the profound influence of T2DM on HRQoL is essential to healthcare professionals and stakeholders because it helps them to customize interventions and support services that cover all aspects of patients' lives.[16,19,23] Hence, the present study aimed to assess HRQoL and associated factors among patients with T2DM from PHCs in the Aljouf province of the KSA to plan for policy-driven interventions and improve patient outcomes.

Materials and Methods
Study Description
The present survey used an analytical cross-sectional design. It was conducted from June 2024 to December 2024 in the Aljouf province of the KSA, which is in the northern part of the country. In the KSA, healthcare delivery, including diabetes management, is delivered through different levels, ranging from PHCs to specialized diabetes clinics. While urban regions such as Riyadh and Jeddah are equipped with advanced tertiary care services, northern provinces like Aljouf rely heavily on PHCs for chronic disease management, including diabetes care. The present study included Saudi

adults (≥18 years) diagnosed with T2DM at least six months before the study who had completed at least one follow-up visit at the PHC. We excluded those with mental illnesses that could affect their ability to comprehend (such as major depressive disorder and cognitive impairment), those with physical disability (that significantly limited their mobility), pregnant women, those with other types of diabetes, hospitalized patients, those on only lifestyle management, and those who were unwilling to participate.

Sampling Procedures

The present survey utilized the WHO sample size calculator, which uses Cochran's sample size estimation principles.[24] Considering the expected variation in HRQoL across the regions, we used 50% as the expected proportion (p) to calculate the sample size. Other factors considered were a 5% margin of error, a 95% confidence interval, and an 80% power of the study. We applied all these values to the sample size calculator and obtained 384 as the minimum number of participants. The present study used a non-probability convenient sampling method to select the required participants. Initially, we selected 10 PHCs from all available centers across Aljouf province to ensure geographical representation. Within each center, eligible patients with T2DM were approached consecutively after their follow-up appointments, and participation was voluntary. To ensure adequate distribution over time and minimize selection bias, we limited enrollment to a maximum of five participants per center per day. Data collection was continued until the target sample size was reached.

Data Collection Steps

The authors conducted this study in accordance with the Declaration of Helsinki. First, we received the necessary ethical clearances from the authorities concerned (Riyadh Second Health Cluster, approval no:24–553E). Second, the authors obtained permission from other authorities to collect patient data. After briefing the participants about the study and obtaining informed consent, we asked the patients with T2DM to complete the survey on the data collectors' devices through Google Forms. However, only the principal investigator could access the backend of the Google form to ensure data protection according to the ethical review board instructions. The authors collected only anonymous data; only the study's overall findings are presented in the manuscript.

Data Collection Instrument

The authors used the validated SF-20-Arabic version to collect data from patients with T2DM and assess multiple health dimensions.[25] This tool solves the problems that many researchers have with the length of their surveys. The tool was created to lessen the time load on respondents while maintaining the goal to be achieved, and it improves the response rate. SF-20 was initially developed in English by the RAND medical outcome study.[25] The present study's research team translated the survey questionnaire into Arabic, and the authors followed standard protocols to ensure accuracy and cultural relevance.[25–27] The translation involved the following process: first, a bilingual translator whose native language is Arabic performed the forward translation, followed by a backward translation into English by an independent translator. Next, a panel of family medicine, public health, and internal medicine experts analyzed both versions to validate the translation process. They ensured that each item maintained the same meaning as the original English version. The translated questionnaire was tested using a pilot study (32 patients with T2DM) to check its adaptability to local settings, validity, and reliability. All pilot study participants provided input, indicating that the instrument was straightforward and easy to comprehend. Cronbach's alpha values for all domains were greater than 0.70, indicating acceptable internal consistency and reliability for use in the target population. The questionnaire consisted of two sections. The first section gathered sociodemographic and health-related information, including age, sex, monthly income, and diabetes duration. The second section evaluated the HRQoL of participants using the SF-20-Arabic version. The SF-20 is a popular instrument for measuring HRQoL among patients with chronic conditions in research and clinical settings.[25,28,29] The SF-20 assesses HRQoL across six predefined domains: physical functioning (six questions), role functioning (two questions), social functioning (one question), mental health (five questions), health perceptions (five questions), and pain (one question). Most items have multiple-choice response options, and the respondents choose the option that best describes their situation over a specific period, usually the last one or three months. Researchers can get

an overview of an individual's HRQoL, including all domains and individual domains. Each domain score is converted into 100%. Here, 0% indicates the lowest in that domain, and 100% indicates the highest score. The scoring is reversed when needed to ensure that the highest score always reflects the optimal score. Finally, we grouped each domain and overall HRQoL score into low (< 50% of total), medium (50 to 75% of total), and high (> 75% of total).

Data Analysis

The present study utilized the Statistical Package for Social Sciences version 24.0 (SPSS V.24) for data exporting, curation, and further analysis. Descriptive data are presented as frequencies, proportions, means, and standard deviations (SD). Initially, Shapiro–Wilk tests and Q-Q plots were used to assess the data for normality; however, the data were skewed. Hence, we applied Mann–Whitney U and Kruskal–Wallis tests for dichotomous and categorical variables, respectively, to each domain. Because non-parametric tests were performed, the mean rank and p-values were presented. Significantly higher mean ranks obtained from the Mann–Whitney U and Kruskal–Wallis tests indicate higher and better HRQoL. Finally, we performed a multivariate analysis to identify the sociodemographic and health-related factors associated with HRQoL. For the multivariate analysis, we used a binomial logistic regression analysis (enter method), where all selected independent variables were entered into the model simultaneously. We adjusted for age, sex, education, occupation, marital status, income, smoking, body mass index (BMI), follow-up, duration of diabetes, treatment type, and presence of chronic diseases in the model. We determined the confidence intervals (CIs) and adjusted odds ratios (AORs) using the logistic regression model. A p-value of less than 0.05 was considered statistically significant.

Results

The authors contacted 456 patients to get the required study participants, with a response rate of 85.5%. Of the 390 patients with T2DM, the majority (41.0%) were aged 46 to 60 years, males (55.6%), currently married (63.1%), working in private sectors (40.8%), non-smokers (64.9%), and within the normal BMI range (45.6%). Regarding their diabetes-related care, 66.7% were regularly being followed up at the health centers, and 69.7% were administered only oral hypoglycemic agents (OHAs) (Table 1).

Table 1 Background and Health-Related Profiles of Type 2 Diabetes Mellitus (T2DM) Patients (n = 390)

Characteristics	Frequency	Percentage
Age (years)		
≤ 45	127	32.6
46 to 60	160	41.0
> 60	103	26.4
Sex		
Male	217	55.6
Female	173	44.4
Education		
Up to school	166	42.6
University and above	224	57.4
Occupation		
Government sector	107	27.4
Private sector	159	40.8
Retired	30	7.7
Unemployed	94	24.1

(*Continued*)

Table 1 (Continued).

Characteristics	Frequency	Percentage
Marital status		
Married	246	63.1
Single	99	25.4
Divorce /Widow	45	11.5
Income (Saudi Riyals [SAR])*		
Less than 5000	128	32.8
5000 to 10000	191	49.0
More than 10000	71	18.2
Smoking		
No	253	64.9
Yes	137	35.1
Body mass index (BMI)		
Normal	178	45.6
Overweight	145	37.2
Obese	67	17.2
Follow-up regularly		
Yes	260	66.7
No / Not sure	130	33.3
Duration of diabetes (years)		
< 2	113	29.0
2 to 5	132	33.8
> 5	145	37.2
Treatment		
Insulin	65	16.7
Oral hypoglycemic agents (OHA)	272	69.7
Both	53	13.6
Presence of Chronic disease		
No	252	64.6
Yes	138	35.4

Note: * 1 USD = 3.75 SAR.

The descriptive data (mean, SD, median, and IQR [interquartile range]) of the six HRQoL domains are shown in Table 2. The role functioning domain had the highest mean score (75.7 ± 19.7), followed by physical functioning (71.9 ± 15.4) and health perception (57.5 ± 7.17) domains. The overall score was 53.2 ± 16.2.

Table 2 Health-Related Quality of Life (HRQoL) Domains Evaluated by SF-20

Domains	Mean (SD)	Median (IQR)
Health Perceptions	57.5 (7.2)	56 (64–52)
Physical Functioning	71.9 (15.4)	72 (78–61)
Pain	48.9 (21.4)	50 (67–33)

(*Continued*)

Table 2 (Continued).

Domains	Mean (SD)	Median (IQR)
Role Functioning	75.7 (19.7)	79 (100 −67)
Social Functioning	47.9 (20.2)	44 (67–33)
Mental Health	51.3 (15.8)	50 (58–33)
Total	53.2 (16.2)	55 (66–36)

The relationship between the characteristics of patients with T2DM and health perception, physical functioning, and pain domains is shown in Table 3. The health perception domain was significantly associated with sex (p = 0.007), education status (p = 0.001), marital status (p = 0.035), follow-up (p = 0.038), and smoking status (p = 0.014). The physical functioning domain was significantly associated with occupation (p = 0.042), marital status (p = 0.018), income (p = 0.001), and duration of diabetes (p = 0.005). We found that age (p = 0.002), occupation (p = 0.001), BMI (p = 0.021), and duration of diabetes (p = 0.012) were significantly associated with the pain domain. The type of treatment received by the T2DM patients was significantly associated with all three domains.

Table 3 Relationship Between T2DM Patients' Characteristics with Health Perception, Physical Functioning, and Pain Domains

Characteristics	Total	Health Perception		Physical Functioning		Pain	
		Mean Rank	p-value*	Mean Rank	p-value*	Mean Rank	p-value*
Age (years)							
≤ 45	127	176.21	0.101	204.66	0.255	200.93	0.002
46 to 60	160	182.96		184.38		174.38	
> 60	103	208.77		221.61		221.61	
Sex							
Male	217	209.09	0.007	202.09	0.195	204.46	0.071
Female	173	178.46		187.29		184.29	
Education							
Up to school	166	218.03	0.001	198.32	0.668	207.47	0.064
University and above	224	178.81		193.41		186.63	
Occupation							
Government sector	107	210.79	0.304	194.03	0.042	202.44	0.001
Private sector	159	179.14		181.54		165.66	
Retired	30	219.82		240.07		291.63	
Unemployed	94	185.26		206.56		207.39	
Marital status							
Married	246	202.22	0.035	222.61	0.018	204.33	0.084
Single	99	175.08		190.22		183.04	
Divorce /Widow	45	183.56		159.26		160.15	

(*Continued*)

Table 3 (Continued).

Characteristics	Total	Health Perception		Physical Functioning		Pain	
		Mean Rank	p-value*	Mean Rank	p-value*	Mean Rank	p-value*
Income (SAR)*							
Less than 5000	128	167.03	0.001	209.27	0.001	187.68	0.001
5000 to 10000	191	190.08		173.93		179.96	
More than 10000	71	261.42		228.69		251.41	
Smoking							
No	253	214.30	0.014	190.87	0.266	190.65	0.236
Yes	137	185.32		204.04		204.46	
BMI							
Normal	178	186.76	0.176	187.11	0.510	219.56	0.021
Overweight	145	186.68		191.62		183.55	
Obese	67	213.60		206.27		188.81	
Follow-up regularly							
Yes	260	193.69	0.038	198.59	0.439	197.24	0.658
No	130	219.12		189.32		192.02	
Duration of diabetes (years)							
< 2	113	211.21	0.168	223.97	0.005	215.17	0.012
2 to 5	132	184.78		180.38		200.77	
> 5	145	193.01		187.08		175.37	
Treatment							
Insulin	65	179.88	0.001	189.38	0.001	181.76	0.001
OHA	272	268.68		243.63		249.84	
Both	53	184.68		167.90		199.40	
Presence of Chronic disease							
No	252	191.04	0.284	191.80	0.376	191.58	0.341
Yes	138	203.64		202.26		202.66	

Notes: * Analysis performed: Mann–Whitney *U*-test for dichotomous variables and Kruskal–Wallis test for categorical variables.

The relationship between patients' characteristics and the role of functioning, social functioning, and mental health domains are presented in Table 4. Among the participants, the role of the functioning domain was significantly related to sex (p = 0.003), income (p = 0.001), smoking status (p = 0.027), follow-up (p = 0.007), treatment type (p = 0.007), and presence of other chronic diseases (p = 0.029). Age (p = 0.001), education status (p = 0.003), marital status (p = 0.004), and duration of diabetes (p = 0.038) were significantly associated with the social functioning domain. Additionally, the mental health domain was significantly related to sex (p = 0.001), education (p = 0.022), occupation (p = 0.017), monthly income (p = 0.042), and follow-up (p = 0.016).

Based on the classification described earlier, the proportions of patients with high-level HRQoL varied across domains, being highest in the role of functioning domain (48.2%) and lowest in the health perception domain (16.6%). We found that 41% of the patients belonged to the high HRQoL category (Table 5).

The binomial logistic regression analysis found that the overall HRQoL was significantly higher among those with the following characteristics: male (Reference [ref]: female; AOR = 2.66, 95% CI = 1.43–3.82, p = 0.002) and those on

Table 4 Relationship Between T2DM Patients' Characteristics with Role of Functioning, Social Functioning, and Mental Health Domains

Characteristics	Total	Role Functioning		Social Functioning		Mental Health	
		Mean Rank	p-value	Mean Rank	p-value	Mean Rank	p-value
Age (years)							
≤ 45	127	195.54	0.859	179.79	0.001	177.43	0.074
46 to 60	160	192.52		182.82		201.78	
> 60	103	200.09		234.56		208.01	
Sex							
Male	217	210.26	0.003	209.53	0.452	213.27	0.001
Female	173	176.99		187.90		173.21	
Education							
Up to school	166	196.24	0.908	208.78	0.025	210.41	0.022
University and above	224	194.95		185.66		184.45	
Occupation							
Government sector	107	227.14	0.073	205.43	0.001	207.07	0.017
Private sector	159	182.60		177.44		181.15	
Retired	30	214.77		261.63		263.17	
Unemployed	94	166.53		193.63		185.00	
Marital status							
Married	246	189.80	0.593	205.89	0.004	205.48	0.082
Single	99	228.03		173.72		181.31	
Divorce /Widow	45	157.89		165.24		182.41	
Income (SAR)*							
Less than 5000	128	224.68	0.001	191.38	0.007	175.48	0.042
5000 to 10000	191	159.86		185.73		203.96	
More than 10000	71	238.77		229.77		208.82	
Smoking							
No	253	208.92	0.027	190.92	0.222	195.20	0.941
Yes	137	170.72		203.96		196.06	
BMI							
Normal	178	200.60	0.942	188.85	0.927	207.85	0.705
Overweight	145	194.73		195.57		198.81	
Obese	67	192.00		195.81		189.43	
Follow-up regularly							
Yes	260	206.01	0.007	195.46	0.991	201.04	0.016
No	130	174.48		195.58		184.42	
Duration of diabetes (years)							
< 2	113	209.07	0.053	194.57	0.038	179.98	0.069
2 to 5	132	186.85		212.09		212.18	
> 5	145	197.21		181.12		192.41	

(Continued)

Table 4 (Continued).

Characteristics	Total	Role Functioning		Social Functioning		Mental Health	
		Mean Rank	p-value	Mean Rank	p-value	Mean Rank	p-value
Treatment							
Insulin	65	190.39	0.007	186.26	0.001	213.52	0.102
OHA	272	240.18		244.73		196.17	
Both	53	166.95		182.55		169.95	
Presence of Chronic disease							
No	252	204.41	0.029	191.76	0.321	197.83	0.575
Yes	138	179.22		202.34		191.25	

Notes: * Analysis performed: Mann–Whitney *U*-test for dichotomous variables and Kruskal–Wallis test for categorical variables.

Table 5 Distribution of HRQoL Domain Scores by Category (n = 390)

Domains	Low n (%)	Medium n (%)	High n (%)
Health Perceptions	196 (50.3)	129 (33.1)	65 (16.6)
Physical Functioning	54 (13.8)	240 (61.5)	96 (24.6)
Pain	168 (43.1)	114 (29.2)	108 (27.7)
Role Functioning	75 (19.2)	127 (32.6)	188 (48.2)
Social Functioning	107 (27.4)	122 (31.3)	161 (41.3)
Mental Health	124 (31.8)	145 (37.2)	121 (31.0)
Overall	109 (28.0)	121 (31.0)	160 (41.0)

OHAs (ref: insulin; AOR = 5.18, 95% CI = 2.08–6.92, p = 0.002). A significantly lower level of HRQoL was observed among obese patients (ref: normal weight; AOR = 0.036, 95% CI = 0.79–0.93, p = 0.036), patients with irregular follow-up at the center (ref: regular follow-up; AOR = 0.58, 95% CI = 0.33–0.87, p = 0.004), and those with other chronic diseases (ref: no comorbidities; AOR = 0.64, 95% CI = 0.52–0.85, p = 0.006; Table 6).

Table 6 Factors Associated with Overall HRQoL Among T2DM Patients. Test Applied: Binomial Logistic Regression Analysis

Variables	Total	Overall HRQoL Categories			
		Low/Medium n = 230	High n = 160	Adjusted Odds Ratio (95% Confidence Interval) *	p-value
Age (years)					
≤ 45	127	74	53	Reference (Ref)	
46 to 60	160	110	50	1.33 (0.54–3.26)	0.533
> 60	103	46	57	0.77 (0.37–1.61)	0.490
Gender					
Female	173	120	53	Ref	
Male	217	110	107	2.66 (1.43–3.82)	0.002

(*Continued*)

Table 6 (Continued).

Variables	Total	Overall HRQoL Categories			
		Low/Medium n = 230	High n = 160	Adjusted Odds Ratio (95% Confidence Interval) *	p-value
Education					
Up to school	166	92	74	Ref	
University and above	224	138	86	1.13 (0.68 −1.90)	0.624
Occupation					
Government sector	107	50	57	Ref	
Private sector	159	116	43	1.16 (0.54–2.51)	0.703
Retired	30	9	21	1.46 (0.75–4.89)	0.221
Unemployed	94	55	39	2.31 (0.72–7.39)	0.158
Marital status					
Married	246	139	107	Ref	
Single	99	58	41	1.78 (0.39–8.15)	0.452
Divorce/widow	45	33	12	0.82 (0.17–4.02)	0.815
Income					
Less than 5000	128	71	57	Ref	
5000 to 10000	191	133	58	1.40 (0.63–3.14)	0.409
More than 10000	71	26	45	0.72 (0.34–1.52)	0.386
Smoking					
No	253	149	104	Ref	
Yes	137	81	56	1.25 (0.71–2.22)	0.441
BMI					
Normal	178	102	76	Ref	
Overweight	145	88	57	0.84 (0.41–1.71)	0.630
Obese	67	40	27	0.79 (0.52–0.93)	0.036
Follow-up regularly					
Yes	260	149	111	Ref	
No	130	81	49	0.58 (0.33–0.87)	0.004
Duration of diabetes					
Less than 1 year	113	55	58	Ref	
2 to 5 years	132	75	57	1.92 (0.94–3.55)	0.066
More than 5 years	145	100	45	1.73 (0.91–3.30)	0.096
Treatment					
Insulin	65	19	46	Ref	
OHA	272	176	96	5.18 (2.08–6.92)	0.001
Both	53	35	18	1.16 (0.58–2.32)	0.675
Presence of Chronic disease					
No	252	151	101	Ref	
Yes	138	79	59	0.64 (0.52–0.85)	0.006

Notes: * Adjusted variables: Age, gender, education, occupation, marital status, income, smoking, BMI, follow-up, duration of diabetes, treatment type, and presence of chronic diseases.

Discussion

The present study assessed HRQoL and associated factors among patients with T2DM attending PHCs in the Aljouf region of the KSA using a validated data collection form. The health perception domain had a moderate mean score of about 57%, indicating that patients with T2DM generally perceived their health as average. Previous studies in KSA and other countries showed varying general health perceptions among study participants.[19,22,30] For instance, Esubalew et al reported slightly higher mean general health perception scores among their study participants.[22] Understanding the sociodemographic and health-related variables that significantly affect this domain is very important. The present study identified sex, education level, marital status, smoking habit, and regular follow-up at the PHCs as significant factors. Participants with a higher level of education and males had high health perception scores; this implies a better under-standing of their challenges because diabetes education plays a significant role in diabetes care.[18,31,32] For example, Homady et al found that HRQoL was significantly higher among patients with higher qualifications.[18] Married patients obtained higher health perception values; such patients are believed to benefit from existing emotional and social support systems. Our findings are similar to those of some studies, which also reported low HRQoL among T2DM patients and contrast with those of others, where higher HRQoL scores were reported.[22,33,34] The varying results across the studies are attributed to study settings, data collection tools used, and sociocultural factors such as family support and access to care.

The present study revealed a relatively higher mean score and a lesser proportion (14.5%) of low categories in the physical functioning domain. This finding suggests the effectiveness of existing diabetes care at the PHCs of the KSA. We found that physical functioning scores were lower among those with a long duration of T2DM, reflecting the progressive impact of the disease on physical abilities over time. Similar to the present study, Alshahrani et al in the KSA,[35] Esubalew et al in Ethiopia,[22] and Tusa et al in Sub-Saharan countries[36] demonstrated the association between quality of life and disease duration. Moreover, currently, married participants have higher scores in this domain, which could be due to the practical support provided by partners, as previously discussed. Social functioning and pain domains had the lowest mean scores of the six domains. The low social functioning domain score indicates that the present study participants had challenges maintaining social relationships and engagement. The social functioning domain score was significantly lower among aged people and patients with a longer duration of diabetes. Additionally, these patients demonstrated lower pain domain scores; along with its significant association with a longer duration of disease, this finding is likely due to the development of chronic complications such as neuropathy and the cumulative disease burden associated with obesity and other chronic diseases.[37–39] A recent study by AbuAlhommos et al reported that pain is one of the most affected domains. They also showed that not having pain is significantly associated with age, sex, duration of diabetes, and some other variables.[19] Therefore, policymakers should consider the social challenges of the patients in addition to physical pain. Furthermore, incorporating pain management services, especially for high-risk patients with T2DM, such as the aged, patients with a higher BMI, and patients with a longer duration of disease, could be beneficial. The findings of this study have important implications for both primary healthcare practice and policy formulation in the KSA. Identifying specific domains with lower HRQoL—such as pain and social functioning—highlights the need for targeted and domain-specific interventions rather than a one-size-fits-all approach.

Our findings showed that role functioning recorded the highest mean score among all domains, indicating that most participants could manage their daily responsibilities effectively despite their condition. The higher scores among participants with higher incomes could be due to limited financial constraints that helped them perform daily tasks better. Moreover, regular follow-up and effective disease management reduce complications, thereby decreasing the financial burden. A recent study by Amin et al stated that higher family income positively correlated with the QoL of their study participants.[40] Similarly, a systematic review by Teli et al also reported the relationship between income and HRQoL among adult patients with T2DM.[41] Some authors evaluated different aspects of mental health and its association with T2DM, and they stated that mental illnesses are more common among patients with T2DM patients, especially those with uncontrolled blood sugar.[42–44] In the present study, less than one-third of the participants belonged to the high category of the mental health domain. Additionally, the mean score of approximately fifty-one indicates mixed outcomes in terms of psychological well-being among participants. The present study revealed that patients who followed the

physicians' instructions had better mental health, demonstrating the importance of consistent healthcare interactions in providing reassurance and addressing emotional concerns.

Our study shows significant differences between HRQoL measures in patients with T2DM patients in primary healthcare and those in patients with pre-dialysis stage or end-stage renal disease (ESRD).[45,46] The HRQoL of patients with chronic kidney disease (CKD) is low, particularly among people undergoing dialysis. Research has shown that patients with diabetes undergoing hemodialysis have worse HRQoL scores in the physical and mental dimensions than their non-diabetic counterparts. This indicates that early interventions for primary care patients with T2DM are of paramount importance because uncontrolled diabetes is a leading cause of renal failure. A recent study supports our finding, showing that HRQoL deteriorates with the progression of chronic diseases.[47]

Our study revealed that only 40% of the participants had a high overall HRQoL. This indicates room for improvement in managing the broader impacts of T2DM on quality of life. HRQoL was significantly higher among males and those administered OHAs. The better scores in OHA groups were attributed to numerous factors, including better adherence and ease of use compared to insulin therapy. The observed negative association of obesity with the overall HRQoL and its other domains may be due to several direct and indirect factors, including pathophysiological and psychological factors. Previous studies conducted in different settings have shown varying overall and domain scores. Similarly, the predictors of poor HRQoL also varied across settings.[18,19,21,36] The variation across studies may be due to differences in socioeconomic conditions, availability and accessibility of healthcare services, and research methods. The significant associations with factors like obesity, comorbidities, and irregular follow-ups suggest that routine HRQoL assessments should be integrated into T2DM management protocols at the PHC level. These insights can inform future patient-centered care models, guide resource allocation, and shape health education programs.

The authors conducted this survey using a standard and validated instrument to reach a conclusion. To our knowledge, this is one of the first studies to use the Arabic SF-20 to assess the HRQoL among patients with T2DM in PHCs in the Aljouf region of the KSA. The study represents various locations, using a multi-site sample from ten PHCs and providing both statistical adequacy and practical value for primary care treatment. The research presents domain-specific HRQoL assessments, making it possible to develop more accurate clinical and policy solutions. The research results provide essential baseline information that can be used in designing future longitudinal or interventional studies. However, a few limitations should be noted while interpreting the study findings. First, as discussed earlier, the HRQoL life is influenced by numerous factors. Hence, the generalizability of this study's findings is limited. Second, the data from patients with T2DM was self-reported, and the possibility of an exaggerated response and recall bias must not be overlooked. Next, this study did not include certain psychosocial and environmental factors that could influence the HRQoL. These unmeasured variables may have influenced the findings and should be considered in future mixed-method or longitudinal studies. Additionally, we did not collect laboratory data, which could have provided deeper insight into disease control and its impact on HRQoL. Finally, the present study was conducted in PHCs. Hence, excluding patients from other healthcare facilities, such as secondary or tertiary care hospitals, represents a limitation.

Conclusion

The present survey provides important insights into the HRQoL of patients with T2DM attending PHCs in the central KSA. The scores varied across HRQoL domains, with role functioning scoring the highest, and pain and social functioning identified as areas of concern. Furthermore, some characteristics, such as marital status, type of treatment, and follow-up adherence, were significantly associated with most domains and the overall HRQoL. Therefore, we recommend policy changes in primary healthcare protocols to integrate routine HRQoL assessments for patients with T2DM. The research results support the creation of new primary healthcare protocols to add standard HRQoL evaluations for patients with T2DM. Specific strategies should include structured patient education protocols and pain management centers at PHCs. Our study findings suggest implementing interventions that focus on high-risk patients with T2DM, including those with obesity, irregular follow-up adherence, and longer disease duration. These healthcare approaches should become part of established chronic disease management guidelines to offer holistic diabetes care. Furthermore, prospective follow-up of the impact of implemented programs on the HRQoL of patients with T2DM is necessary. Moreover, incorporating pain management specialty clinics into PHCs, especially for high-risk patients with

T2DM, may be beneficial. Finally, we recommend performing multicentric mixed-method studies, which can provide deeper insights into the psychosocial, emotional, and cultural factors affecting HRQoL among patients with T2DM, aspects that are often not fully captured through quantitative tools alone.

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