Diabetes, Metabolic Syndrome and Obesity

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

Quality of Life and Diabetic Complications Among Type 2 Diabetes Patients Across Healthcare Levels in Bandung, Indonesia

Ervita Ritonga[1], Auzia Tania Utami[1], Afifah Nur Yusdianti[2], Sharon Gondodiputro[3], Nanny Natalia Soetedjo[1], Bachti Alisjahbana[1,2], Hikmat Permana[1]

[1]Department of Internal Medicine, Universitas Padjadjaran/Hasan Sadikin General Hospital, Bandung, Indonesia; [2]Department of Dengue and Other Fevers, Research Center for Care and Control of Infectious Disease, Universitas Padjadjaran, Bandung, Indonesia; [3]Department of Public Health, Faculty of Medicine, Universitas Padjajaran, Bandung, Indonesia

Correspondence: Hikmat Permana, Department of Internal Medicine, Faculty of Medicine, Universitas Padjadjaran/Dr. Hasan Sadikin General Hospital, Jl. Pasteur No. 38, Bandung, West Java, 40161, Indonesia, Email hikmat.permana@unpad.ac.id

Purpose: To analyze differences in quality of life (QoL) among patients with Type 2 Diabetes Mellitus (T2DM) across three levels of healthcare facilities in Bandung, Indonesia, and to identify factors associated with poor QoL.

Methods: This cross-sectional analytical study involved 369 adult T2DM patients from primary, secondary, and tertiary healthcare facilities in Bandung, Indonesia. The participants were enrolled in the National Health Insurance program and had available data on blood glucose levels, diabetes-related complications, and treatments. Quality of life was assessed using the Indonesian version of the Asian Diabetes Quality of Life (ADQOL) questionnaire.

Results: Significant differences in patient characteristics were observed across the three healthcare levels. The highest proportion of patients experiencing multiple complications was found in secondary and tertiary care settings (62.5% and 63.3%, respectively). Patients attending secondary healthcare facilities had the worst quality of life (40.2%), followed by those in tertiary and primary care (33.0% and 26.8%, respectively). Although QoL revealed variability across healthcare levels, it was not statistically significant. Multivariate analysis revealed that complications were significantly associated with poor QoL (one complication: AOR = 4.118, 95% CI: 1.567–10.827).

Conclusion: While patient characteristics varied among healthcare facility levels, they did not independently associate with quality of life. Instead, diabetes complications are significantly associated with quality of life for T2DM patients in Bandung, Indonesia. Although this study limited by its cross-sectional design, this finding highlights the need for screening and early management of complications across all levels of healthcare to improve patient QoL.

Keywords: type 2 diabetes mellitus, quality of life, healthcare levels, diabetic complications, ADQOL, Indonesia

Introduction

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disease affecting 415 million adults worldwide, with 20% of these individuals residing in Southeast Asia.[1] People with T2DM have a significant risk of developing microvascular and macrovascular complications. These complications can significantly decrease the quality of life (QoL).[2,3] The association between complication and reduced QoL can be explained through multiple pathways. Physically, complications such as neuropathy, retinopathy, and nephropathy cause pain, functional limitation, and loss of independence.[4,5] Psychologically, the presence of complications increase distress, anxiety and depressive symptoms.[6] Together, these pathways may lead to decreased QoL.

Besides diabetes-related complications, frailty syndrome has become a significant factor influencing the outcomes of T2DM patients, particularly among older adults.[7] It is characterized by reduced reserve and resistance to stressors because of decreased efficiency of physiological systems.[8] Its prevalence markedly higher in individuals with diabetes relative to the general population. Studies have shown that frailty is associated with greater healthcare utilization, reduced functional independence,

Received: 15 July 2025
Accepted: 18 November 2025
Published: 6 December 2025

and lower quality of life among diabetic patients.[7] Although our study focuses on complications and healthcare facility levels, acknowledging frailty highlights the multidimensional nature of QoL in T2DM.

Measuring quality of life is essential for patients with chronic diseases. According to the World Health Organization (WHO), quality of life reflects how individuals perceive their overall position in life within the context of their culture, values, and personal expectations.[9,10] Quality of life has become a recognized health assessment in recent years, especially for patients with chronic diseases such as T2DM.[11–13] One tool to measure this is the Asian Diabetes Quality of Life (ADQOL) questionnaire. The ADQOL questionnaire includes 21 items distributed across five domains: dietary behavior, economic status, physical condition, psychosocial state, and sexual health.[14,15] Asian Diabetes Quality of Life was translated into several languages, with a scoring system based on the 25th, 50th, and 75th centiles. A score below the 25th centile is considered poor, and a score above the 75th is considered excellent.[14]

Patients with T2DM typically require regular visits to healthcare facilities. Indonesian healthcare systems consist of primary, secondary, and tertiary care levels. Patients with simple cases of T2DM are usually managed in primary healthcare facilities. In contrast, patients with difficult-to-control blood sugar levels or those facing potential complications consult higher-level facilities.[16] In addition, Indonesia's healthcare system is marked by socioeconomic disparities and uneven distribution of resources. While the national insurance provides coverage, patients with lower socioeconomic may still face barriers in accessing secondary and tertiary care due to transportation costs, long waiting times, and referral complexities.[17,18]

The difference between patients' characteristics and care provided at different levels potentially affects patients' outcomes and, consequently, their quality of life. Previous studies have shown that the quality of life of DM patients across various levels of healthcare facilities in Indonesia varies considerably.[19–22] In 2012, Larasati conducted a study at Abdul Meoloek Hospital using an SF-36 questionnaire and found that 13.5% of participants had poor quality of life.[19] Another study in 2020 conducted by Umam et al revealed that 4.4% of participants at the Wanaraja Community Health Center in Garut had poor quality of life.[21] These previous studies did not compare the quality of life across different levels of healthcare facilities.[19–22] These studies mainly focused on clinical outcome on one healthcare level making the knowledge about whether the differences in patient characteristics and ability resources translate into measurable differences in quality of life. Understanding the difference will provide new evidence on how referral patterns and service delivery may shape patient experiences. These will help in prioritizing interventions to improve QoL among diabetic patients. Therefore, this study aims to describe the quality of life of individuals with T2DM assessed by the ADQOL questionnaire, which is culturally tailored for the population, in three levels of healthcare facilities in Bandung, Indonesia. We would also like to identify the associated factors of poor QoL.

Methods

We conducted this observational, analytical study using a cross-sectional design, in which exposure and the outcome variable were measured simultaneously, from July to September 2023. The research sample comprised individuals with T2DM who were seeking treatment at three different healthcare facilities level in Bandung, Indonesia. These facilities included the outpatient unit of the Kota Bandung Community Health Centre as the primary healthcare provider; Bandung Kiwari Regional General Hospital and Bandung Regional General Hospital as secondary healthcare providers; and Dr. Hasan Sadikin Hospital Bandung as the tertiary healthcare facility.

The inclusion criteria for participants in this study are T2DM patients aged 18 years and older who are proficient in reading and understanding the Indonesian language. They must be enrolled in the National Health Insurance program, married, and still have a partner. They should not have a history of treatment at different healthcare service levels within the past year and must not have previously completed the ADQOL questionnaire. Participants' medical records, reviewed within the last three months, provided data on fasting blood glucose (FBG), two-hour postprandial blood glucose (2hPPBG), complications, and treatments. Although patients with incomplete data regarding these variables were set as exclusion criteria, all medical records were complete, and all questionnaires were fully answered; therefore, no participants were excluded for this reason.

Data collection was performed using consecutive sampling. The minimum required sample size for each healthcare level was calculated using a two-proportion Z-test ($\alpha = 0.05$, $\beta = 0.10$, power = 90%, margin of error = 5%), which indicated a minimum of 120 T2DM patients per level. After obtaining written informed consent from the subjects,

interviews and medical record reviews were conducted. Socio-demographic characteristics, including age, gender, education, and income, were obtained by interview with subjects. Income was categorized as below or above the Bandung minimum wage. Clinical data, including body mass index (BMI), glycemic control, therapy, and complications, were collected from medical records.

Body mass index was classified using Asia Pacific criteria: underweight (<18.5 kg/m^2), normal (18.5–22.9 kg/m^2), overweight (23.0–24.9 kg/m^2), obese I (25.0–29.9 kg/m^2), and obese II (≥ 30 kg/m^2).[23] Glycemic control was categorized as controlled or uncontrolled. Controlled subjects had a fasting glucose of 80–130 mg/dL, postprandial glucose < 180 mg/dL, or HbA1c ≤ 7 mg/dL.[16] Complications were identified from physician diagnoses recorded in medical charts. Later, the complications were classified according to the number of complications: none, one complication, and more than one complication. The study team collected therapy information from prescriptions in medical records, and they categorized these into oral hypoglycemic agents (OHA), insulin, GLP-1 receptor agonists (GLP1A), and combination therapy.

Quality of life data were collected using the Indonesian version of the ADQOL questionnaire, which had previously been validated.[15] This self-administered instrument was distributed to participants during the visit for routine consultation. Completed questionnaires were checked, and participants were asked to clarify any missing or unclear responses on the same day. Quality of life was classified as poor if the ADQOL score was below the 25th percentile, moderate if it lay between the 25th and 49th percentiles, good if it fell between the 50th and 74th percentiles, and excellent if it was at or above the 75th percentile.[14]

The data analysis was conducted using Statistical Product and Service Solutions (SPSS) for Windows version 27.0. Continuous variables such as BMI and diabetes duration were categorized before analysis. All variables were treated as categorical in the final dataset. Descriptive statistics were presented as frequencies and percentages. Group comparisons were tested using Chi-square test. Variables with a p-value of ≤ 0.25 in bivariate analysis were further analyzed using a multivariable logistic regression, as Hosmer–Lemeshow recommendations, to identify independent predictors associated with poor quality of life. Odds ratios (OR) with 95% confidence intervals (CI) were reported. Statistical significance was defined as p <0.05. The Health Research Ethics Committee of Dr. Hasan Sadikin Hospital approved this study in Bandung, with reference number LB.02.01/X.6.5/188/2023. The study followed the ethical principles of the Declaration of Helsinki. To ensure confidentiality, personal identifiers were anonymized. The data were securely stored with access limited to the research team.

Results

In this study, we recruited 369 participants from different levels of healthcare facilities. Table 1 summarizes the basic characteristics of the three groups. We observed significant differences across the level of healthcare facilities for most of the variables.

The data from Table 1 revealed that most participants were between 18 and 64 years old, with the highest percentage (75%) found in the tertiary group. Female patients were more prevalent across all healthcare facilities. The educational backgrounds

Table 1 Patient Characteristics According to Health Care Facility

Characteristics	Total n= 369	Primary n= 129	Secondary n= 120	Tertiary n= 120	p-value
	n (%)	n (%)	n (%)	n (%)	
Demography					
Sex					<0.001*
Male	116 (31.4)	36 (27.9)	22 (18.3)	58 (48.3)	
Female	253 (68.6)	93 (72.1)	98 (81.7)	62 (51.7)	
Age group					<0.001*
< 65	244 (66.1)	65 (50.4)	89 (74.2)	90 (75.0)	
≥ 65	125 (33.9)	64 (49.6)	31 (25.8)	30 (25.0)	

(*Continued*)

Table 1 (Continued).

Characteristics	Total n= 369	Primary n= 129	Secondary n= 120	Tertiary n= 120	p-value
	n (%)	n (%)	n (%)	n (%)	
Education					<0.001*
No formal education, Elementary school, Junior high school	172 (46.6)	67 (51.9)	68 (56.7)	37 (30.8)	
Senior high school	112 (30.4)	42 (32.6)	37 (30.8)	33 (27.5)	
Higher education	85 (23)	20 (15.5)	15 (12.5)	50 (41.7)	
Income					<0.001*
Low	307 (83.2)	114 (88.4)	110 (91.7)	83 (69.2)	
High	62 (16.8)	15 (11.6)	10 (8.3)	37 (30.8)	
Body Mass Index					<0.001*
Underweight	10 (2.7)	4 (3.1)	5 (4.2)	1 (0.8)	
Normal	98 (26.6)	29 (22.5)	39 (32.5)	30 (25)	
Overweight	76 (20.6)	19 (14.7)	25 (32.9)	32 (26.7)	
Obesity class I	128 (34.7)	62 (48.1)	39 (32.5)	27 (22.5)	
Obesity class II	57 (15.4)	15 (26.3)	12 (10.0)	30 (25.0)	
Hypertension					0.007*
Yes	238 (64.5)	88 (68.2)	64 (53.3)	86 (71.7)	
No	131 (35.5)	41 (31.8)	56 (46.7)	34 (28.3)	
Controlled blood pressure					<0.001*
Controlled	157/238 (66.0)	75/238 (85.2)	37/238 (57.8)	45/238 (52.3)	
Uncontrolled	81/238 (34.0)	13/238 (14.8)	27/238 (42.2)	41/238 (47.7)	
History of Diabetes Mellitus					
Duration of T2DM					<0.001*
< 5 years	182 (49.3)	52 (40.3)	78 (65)	52 (43.3)	
≥ 5 Years	187 (50.7)	77 (59.7)	42 (35)	68 (56.7)	
Treatment					<0.001*
OHA	238 (64.5)	127 (98.4)	69 (57.5)	42 (35)	
Insulin	78 (21.1)	1 (0.8)	20 (25.0)	47 (39.2)	
OHA-Insulin, GLP1A, OHA-GLP1A, Insulin-GLP1A	53 (14.4)	1 (0.8)	21 (17.5)	31 (25.8)	
Glycemic Control					0.004*
Controlled	157 (42.5)	70 (54.3)	45 (37.5)	42 (35)	
Uncontrolled	212 (57.5)	59 (45.7)	75 (65.2)	78 (65)	
Complications					<0.001*
None	54 (14.6)	38 (29.5)	5 (4.2)	11 (9.2)	
1 complication	125 (33.9)	52 (40.3)	40 (33.3)	33 (27.5)	
> 1 complications	190 (51.5)	39 (30.2)	75 (62.5)	76 (63.3)	

Notes: Data are presented as frequencies and percentages. Body Mass Index classified according to Asia-Pacific criteria: underweight (<18.5 kg/m^2), normal (18.5–22.9 kg/m^2), overweight (23.0–24.9 kg/m^2), obese I (25.0–29.9 kg/m^2), and obese II (≥30 kg/m^2). Statistical significance tested using Chi-square; * $p < 0.05$.
Abbreviations: T2DM, type 2 diabetes mellitus; GLP1A, glucagon-like peptide-1 receptor agonist; OHA, oral hypoglycemic agents.

of the participants varied by facility; patients attending tertiary healthcare facilities were more likely to hold a higher education degree (41,7%), while those at primary and secondary healthcare facilities graduated from lower education levels. Income levels were low among participants in primary and secondary healthcare facilities. Primary healthcare facilities showed the highest percentage of individuals with obesity class I (48.1%) compared to the other healthcare facilities.

More than half of the participants in both primary and tertiary healthcare facilities had been living with T2DM for at least five years, while those in secondary healthcare facilities had lived with it for less than five years. The treatment regimen for T2DM patients in primary and secondary healthcare facilities primarily involved oral antihyperglycemic medications, while insulin was the most commonly used in tertiary healthcare. In the primary healthcare facility, 40.3% of participants experienced one complication, whereas more than half of the participants in both secondary and tertiary healthcare facilities faced multiple complications (Table 1).

Table 2 presents bivariate analyses between the patient characteristics and quality of life, indicating that 97 subjects had a poor quality of life. Education level, healthcare type, BMI, diabetes duration, and complications showed p-values below 0.25, with complications having the lowest (0.017). Across different healthcare facilities, we observed that the lowest quality of life was in the secondary healthcare facilities. However, this difference was not significant. This bivariate analysis did not find the association between quality of life and healthcare facilities.

Table 2 Patient Characteristics According to Quality of Life

Characteristics	Total n= 369	Poor n= 97	Non-Poor n=272	p-value
	n (%)	n (%)	n (%)	
Demography				
Sex				0.897
Male	116 (31.4)	31 (32.0)	85 (31.3)	
Female	253 (68.6)	66 (68.0)	187 (68.8)	
Age group				0.776
< 65	244 (66.1)	63 (64.9)	181 (66.5)	
≥ 65	125 (33.9)	34 (35.1)	91 (33.5)	
Education				0.148
No formal education, Elementary school, Junior high school	172 (46.6)	53 (54.6)	119 (43.8)	
Senior high school	112 (30.4)	27 (27.8)	32 (32.3)	
Higher education	85 (23)	17 (17.5)	24 (24.2)	
Income				0.925
Low	307 (83.2)	81 (83.5)	226 (83.1)	
High	62 (16.8)	16 (16.5)	46 (16.9)	
Health Care Facility				0.145
Primary	129 (35.0)	32 (33.0)	97 (35.7)	
Secondary	120 (32.5)	39 (40.2)	81 (29.8)	
Tertiary	120 (32.5)	26 (26.8)	94 (34.6)	
Body Mass Index				0.215
Underweight	10 (2.7)	4 (4.1)	6 (2.2)	
Normal	98 (26.6)	20 (20.6)	78 (28.7)	
Overweight	76 (20.6)	25 (25.8)	51 (18.8)	
Obesity class I	128 (34.7)	30 (30.9)	98 (36)	
Obesity class II	57 (15.4)	18 (18.6)	39 (14.3)	
Hypertension				0.547
Yes	238 (64.5)	65 (67)	173 (63.6)	
No	131 (35.5)	32 (33)	99 (36.4)	
Controlled blood pressure				0.515
Controlled	157/238 (66)	45/238 (69.2)	112/238 (64.7)	
Uncontrolled	81/238 (34.0)	20/238 (30.8)	61/238 (35.3)	
History of Diabetes Mellitus				
Duration of T2DM				0.145
< 5 years	182 (49.3)	54 (55.7)	128 (47.1)	
≥ 5 Years	187 (50.7)	43 (44.3)	144 (52.9)	
Treatment				0.758
OHA	238 (64.5)	60 (61.9)	178 (65.4)	
Insulin	78 (21.1)	23 (23.7)	55 (20.2)	
OHA-Insulin, GLP1A, OHA-GLP1A, Insulin-GLP1A	53 (14.4)	14 (14.4)	39 (14.3)	
Glycemic Control				0.258
Controlled	157 (42.5)	46 (47.4)	111 (40.8)	
Uncontrolled	212 (57.5)	51 (52.6)	161 (59.2)	

(*Continued*)

https://doi.org/10.2147/DMSO.S549279

Table 2 (Continued).

Characteristics	Total n= 369	Poor n= 97	Non-Poor n=272	p-value
	n (%)	n (%)	n (%)	
Complications				0.017*
None	54 (14.6)	6 (6.2)	48 (17.6)	
1 complication	125 (33.9)	33 (34)	92 (33.8)	
>1 complications	190 (51.5)	58 (59.8)	132 (48.5)	

Notes: Data are presented as frequencies and percentages. Body Mass Index classified according to Asia-Pacific criteria: underweight (<18.5 kg/m^2), normal (18.5–22.9 kg/m^2), overweight (23.0–24.9 kg/m^2), obese I (25.0–29.9 kg/m^2), and obese II (≥30 kg/m^2). p-values derived from Chi-square tests. Variables with p ≤ 0.25 were considered for multivariate analysis. * p < 0.05.
Abbreviations: T2DM, type 2 diabetes mellitus; GLP1A, glucagon-like peptide-1 receptor agonist; OHA, oral hypoglycemic agents.

Table 3 shows a multivariate analysis of factors associated with poor quality of life. After adjusting for confounding factors in the multivariate model, the multivariate logistic regression analysis results revealed predictors with a significance level of p <0.05. This analysis revealed that the number of complications was significantly associated with poor quality of life in patients with type 2 diabetes mellitus. Compared to patients without complications, those with one complication had a 3.35 times higher risk (AOR = 3.354, p = 0.015), and those with more than one complication had a 4.12 times higher risk (AOR = 4.118, p = 0.004) of experiencing poor quality of life. Other variables, including education level, type of healthcare facility, body mass index, and duration of diabetes, were not statistically significant. Other variables were not independently associated with poor QoL.

Figure 1 presents the distribution of quality of life among the participants categorized by the number of complications. Among patients without complications, 11.1% reported low QoL, while most reported moderate or good quality of

Table 3 Factors Associated with Poor Quality of Life in Diabetic Patients

Characteristics	OR	CI (95%)	p-value
Education			
No formal education, elementary school, junior high school	1.684	0.860–3.928	0.129
Senior high school	1.135	0.550–2.341	0.732
Higher education	Ref		
Health Care Facilities			
Tertiary	0.627	0.322–1.223	0.171
Secondary	0.955	0.512–1.783	0.886
Primary	Ref		
Body Mass Index			
Obesity class II	2.046	0.933–4.483	0.074
Obesity class I	1.130	0.580–2.201	0.720
Overweight	1.841	0.902–3.759	0.094
Underweight	2.781	0.666–11.616	0.161
Normal	Ref		
Duration of T2DM			
≥ 5 Years	0.706	0.427–1.167	0.174
< 5 years	Ref		
Complications			
>1 complications	4.118	1.567–10.827	0.004*
1 complication	3.354	1.269–8.867	0.015*
None	Ref		

Notes: p-values derived from logistic regression. Odds ratios (OR) and 95% confidence intervals (CI) are reported. Reference group: patients without complications. * p < 0.05.
Abbreviation: T2DM, type 2 diabetes mellitus.

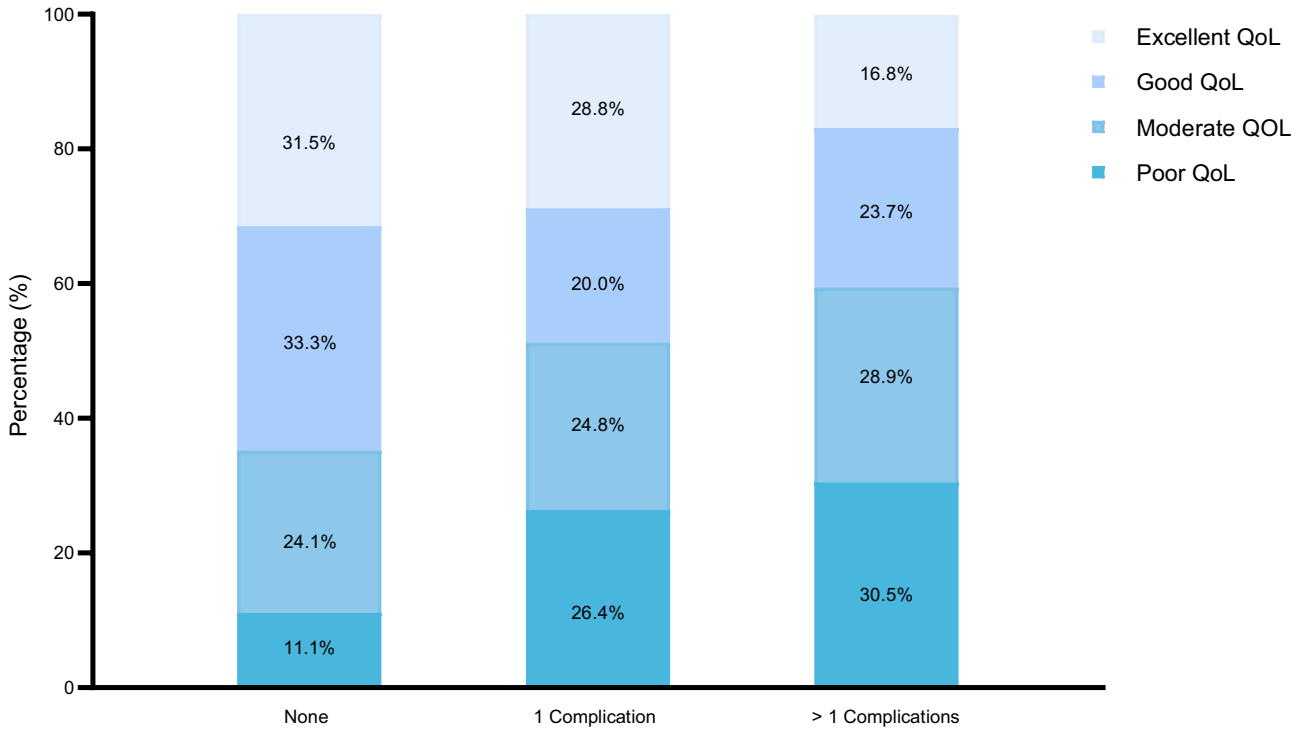

Figure 1 Quality of life of T2DM Patients According to Number of Complications.
Notes: Distribution of quality-of-life (QoL) categories among T2DM patients according to the number of complications: none (n = 54), one complication (n = 125), and more than one complication (n = 190). Percentages are displayed within each bar segment.

life. Patients with one complication reported a more than doubled (26.4%) proportion of poor quality of life. The group with more than one complication showed the highest proportion reporting low QoL (30.5%). This group also exhibited the lowest proportion of participants reporting excellent quality of life.

Figure 2 illustrates the distribution of quality-of-life categories across participants with specific diabetes-related complications. The proportion of poor QOL is higher in patients with micro complications compared to macro complications, with nephropathy (39.2%), neuropathy (29.7%), and retinopathy (31.5%) proportions being higher than in cardiovascular disease (27.3%), PAD (20.6%), and cerebrovascular disease (22.6%). The percentage of patients with excellent quality of life also decreased with complications, with the lowest proportion on cerebrovascular disease (12.9%), followed by nephropathy (13.7%).

Discussion

We observed intriguing patterns in the distribution of patient characteristics across the three levels of healthcare facilities. Using the ADQOL-BI (Indonesian version) questionnaire, we found that most T2DM patients with poor quality of life receive care at secondary healthcare facilities. However, healthcare facilities are not statistically significant regarding poor quality of life. Instead, we discovered a correlation between the patient's quality of life and DM complications.

Education level significantly influences the type of healthcare facility used by patients with T2DM. Individuals with higher education levels are likelier to attend a tertiary care facility, whereas lower education levels are more common in primary care settings. A study by Cheng et al supports this finding, showing a correlation between education and healthcare utilization in Indonesia.[24] Educated individuals are more likely to use hospital services.[18,24] Education provides better access to information, health insurance, and overall health.[18] While our analysis did not find a direct connection between education level and quality of life, it is possible that education indirectly affects quality of life by improving disease understanding and diabetes care.[25]

We observed a higher proportion of obese patients in the primary healthcare facilities. This differs from the study conducted by Permana et al, which reported similar BMIs of T2DM patients in primary and tertiary healthcare.[26] This

https://doi.org/10.2147/DMSO.S549279

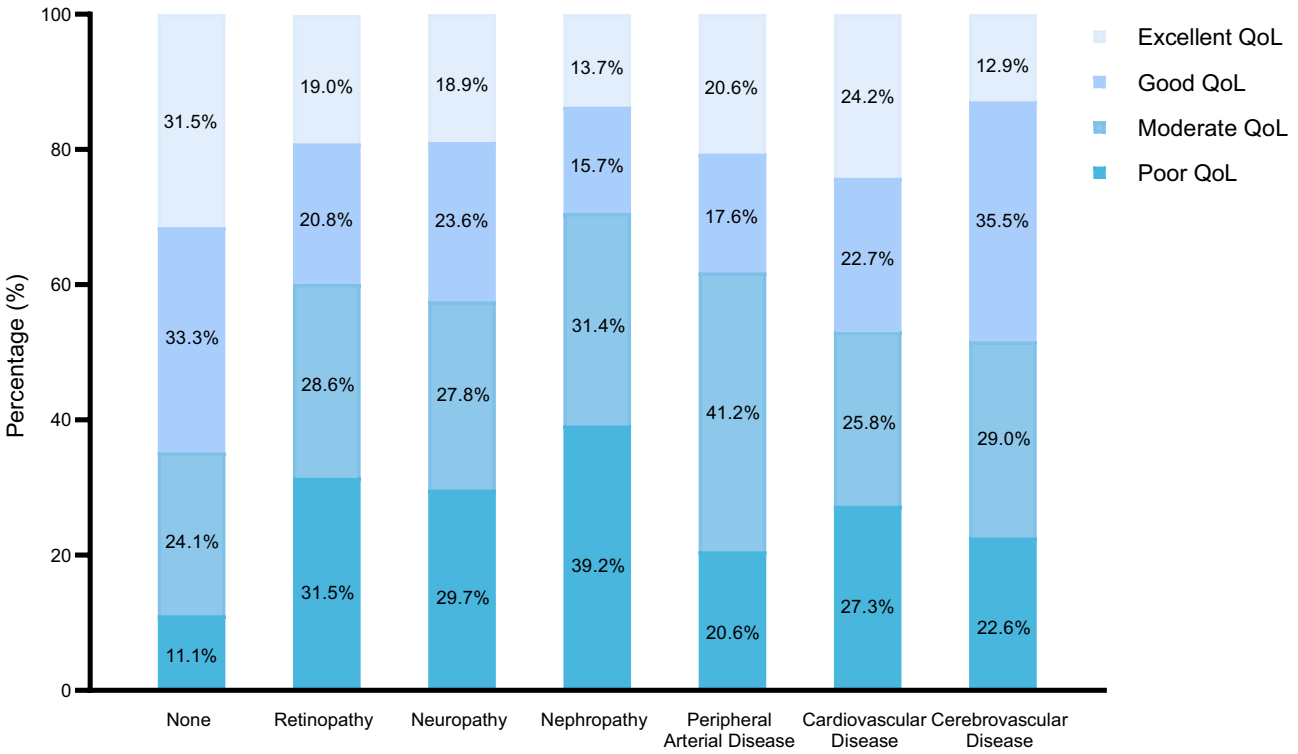

Figure 2 Quality of life of T2DM Patients According to Type of Complications.
Notes: Distribution of quality-of-life (QoL) categories among T2DM patients with specific diabetes-related complications: none (n = 54), retinopathy (n = 168), neuropathy (n = 259), nephropathy (n = 51), peripheral arterial disease (n = 34), cardiovascular disease (n = 66), and cerebrovascular disease (n = 31). Percentages are displayed within each bar segment. $p < 0.05$ for retinopathy, neuropathy, and nephropathy compared with patients without complications (Chi-square test).

might be because of the difference in the patients' complications, especially cerebrovascular disease, between the two studies. The proportion of cerebrovascular disease in primary healthcare facilities is lower than in the previous study. Weight loss is a frequent complication after a stroke. Impaired feeding, muscle wasting due to paresis and reduced physical activity, and possible depression cause weight loss after cerebrovascular disease, leading to lower BMI.[27,28] The lower BMI in larger hospitals may be due to metabolic decompensation and severe complications, including diabetic amyotrophy, which is more common in these settings.[16,29]

More patients in tertiary care had multiple complications, while primary care saw more patients with fewer complications. This distribution reflects the referral patterns within the healthcare system. Indonesia's health care system recommends that DM patients with uncomplicated T2DM be managed in primary care settings, while patients with complications and poor glycemic control should be referred to higher-level facilities.[16]

Analysis of multiple variables reveals a strong link between complications and reduced quality of life. Patients with one or more complications had higher odds of poor quality of life. Several cross-sectional studies indicated that T2DM patients with complications experienced a lower quality of life. According to Trikkalinou et al, diabetic quality of life declines with the development of complications, with two or more leading to significantly lower health-related quality of life scores.[2] Muhammad et al's study of tertiary healthcare patients with T2DM also showed that those without complications reported a high quality of life, suggesting that complications significantly affect the quality of life.[30]

Among the complications we have found, patients with microvascular complications like retinopathy, neuropathy, and nephropathy were more likely to report worse QoL. This contrasts with a Korean study that reported no significant association.[31] Early-stage retinopathy and nephropathy often lack symptoms that limit activity.[5] We used medical records for complication data without specifying stages, which may explain the differing results. A Malaysian study by Tan et al found that nephropathy, retinopathy, and neuropathy were associated with worse health-related quality of life (HRQoL).[4] Microvascular damage frequently results in chronic functional impairments such as pain, vision loss, and renal

insufficiency that directly disrupt daily activities. Macrovascular events, on the other hand, may happen more often or be only partially fixed. A multinational study by Arnold et al showed that both microvascular and macrovascular complications impaired QoL, although the associations were strongest and most consistent for microvascular complications.[5] This indicates that microvascular complications require specific focus for QoL interventions.

Even though patient characteristics across healthcare facilities, including complications, are significantly different between healthcare facilities, healthcare facilities are not significantly associated with poor quality of life. This suggests that it is not the type of facility itself but rather the presence of complications that determines the QoL. This study is comparable to a study conducted in the United Arab Emirates, with a finding of no quality-of-life difference between primary and specialty diabetes care.[32] This is likely due to the proper distribution of patients between the level of disease severity and the level of healthcare facilities.[16] The referral system may help explain this result in the Indonesian context. Primary care managed uncomplicated T2DM patients, while patients with complications or uncontrolled glycemic levels are referred to higher-level facilities.[16] Although secondary and tertiary care saw more complications, appropriate management at better facilities increased patients' QoL.[2,33] Out of the three-level healthcare facility, the secondary level had the lowest QoL among T2DM patients. This might be because the secondary facilities manage patients with more advanced disease than primary care, but with fewer specialized resources than tertiary hospitals. A study in Nigeria reported that patients treated by a specialist physician at tertiary facilities had a better HRQoL than those at secondary facilities.[34] Access barriers further complicate this picture, since tertiary hospitals are concentrated in urban areas, transportation difficulties, and geographic isolation reduce the ability of T2DM patients to access tertiary care services even when they are referred.[17,18] The inability to access tertiary care might overburden the secondary healthcare. This highlights that healthcare system organization and complication control are more critical for QoL than the facility level alone. Therefore, strengthening complication screening and clear referral pathways could prevent delays in managing complications that would improve the outcome of QoL. Increasing resources and the accessibility to healthcare are also important to improve QoL.

Our study provides several contributions to the existing literature. By including participants from three levels of healthcare facilities, we offer a more systematic perspective on the QoL of T2DM patients in Indonesia. The use of a validated Indonesian version of ADQOL ensures cultural relevance, enhancing the policy relevance of our findings.

This study has several limitations. We conducted it using a cross-sectional design, which limits our ability to establish a causal relationship between diabetes-related factors and quality of life. A relatively short data collection period might not fully represent the diversity of patients or capture variations in healthcare facilities throughout the year. We did not include unmarried patients from our study, which may have resulted in overlooking individuals experiencing poorer quality of life or dissatisfaction with clinic services. The BMI and blood glucose levels data were taken from medical records, which could include oversights. Furthermore, we did not have HbA1c data available. HbA1c is a more reliable measure of blood glucose control, but it is not routinely conducted in primary healthcare settings. The study also lacked adequate data about the severity of the complications, which could have impacted the outcomes.

Conclusion

In conclusion, our study shows that diabetic complications are the most important factor in determining the quality of life for people with T2DM. Quality of life showed no direct link to healthcare facilities or blood glucose control. This highlights the importance of screening and early management of complications within all levels of healthcare facilities. Better QoL also requires clear referral systems and equal access to care. Additional studies with larger and longitudinal cohorts are necessary to understand various aspects of the healthcare context and complication type for improving QoL among T2DM patients.

Data Sharing Statement

All relevant data are within the paper. Interested parties may contact the corresponding author for copies of the raw data presented here.

Acknowledgments

We thank the heads of the Pasir Kaliki, Cibuntu, Cijagra Lama, Garuda, Ibrahim Adjie, and Salam community health centers, as well as the heads of the Bandung Kiwari and Kota Bandung Hospital Education and Training Department. Our deepest gratitude goes to the study participants who made this research possible.

Author Contributions

Conceptualization: ER, AT, NNS, BA, HP

Data curation: AT, ER, ANY

Formal analysis: AT, ANY

Investigation: AT, ER

Methodology: ER, AT, SG,

Project administration: AT, NNS

Resources: HP

Supervision: BA, SG, NNS

Validation: BA, HP

Writing – original draft: ER, AT, ANY

Writing – review & editing: HP, ER, AT, ANY, SG, NNS, BA

All authors gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

No funding was received.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Dhillon H, Nordin R, Bin, Ramadas A. Quality of life and associated factors among primary care Asian patients with type 2 diabetes mellitus. *Int J Environ Res Public Health*. 2019;16(19):3561. doi:10.3390/IJERPH16193561
2. Trikkalinou A, Papazafiropoulou AK, Melidonis A. Type 2 diabetes and quality of life. *World J Diabetes*. 2017;8(4):120. doi:10.4239/WJD.V8.I4.120
3. Thapa S, Pyakurel P, Baral DD, Jha N. Health-related quality of life among people living with type 2 diabetes: a community based cross-sectional study in rural Nepal. *BMC Public Health*. 2019;19(1):1–6. doi:10.1186/S12889-019-7506-6/TABLES/4
4. Tan MHP, Ong SC, Bujang MA, Shah SA, Mustafa N. Evaluation of the health-related quality of life of patients with type 2 diabetes in relation to macrovascular and microvascular complications. *Acta Diabetol*. 2023;60(12):1735–1747. doi:10.1007/S00592-023-02164-2/METRICS
5. Arnold SV, Khunti K, Tang F, et al. Impact of micro- and macrovascular complications of type 2 diabetes on quality of life: insights from the discover prospective cohort study. *Endocrinol Diabetes Metab*. 2022;5(2):e00321. doi:10.1002/EDM2.321
6. Satapathy P, Pratima P, Gaidhane AM, et al. Prevalence and impact of microvascular complications in type 2 diabetes mellitus on cognitive impairment and depression: a systematic review and meta-analysis. *Diabetol Metab Syndr*. 2025;17(1):1–9. doi:10.1186/S13098-025-01759-9/FIGURES/5
7. Rashıdı M, Yıldırım G, Karaman F, et al. Determination of the relationship between frailty level and quality of life in elderly individuals with type 2 diabetes. *Sci Rep*. 2024;14(1). doi:10.1038/S41598-024-83766-W
8. Bąk E, Młynarska A, Marcisz C, Bobiński R, Sternal D, Młynarski R. The influence of frailty syndrome on quality of life in elderly patients with type 2 diabetes. *Qual Life Res*. 2021;30(9):2487. doi:10.1007/S11136-021-02829-X
9. Vahedi S. World health organization quality-of-life scale (WHOQOL-BREF): analyses of their item response theory properties based on the graded responses model. *Iran J Psychiatry*. 2010;5(4):140.
10. Spasić A, Radovanović RV, Dordević AC, Stefanović N, Cvetković T. Quality of life in type 2 diabetic patients. *Acta Facultatis Medicae Naissensis*. 2014;31(3):193–200. doi:10.2478/AFMNAI-2014-0024
11. Lam CLK, Lauder IJ. The impact of chronic diseases on the health-related quality of life (HRQOL) of Chinese patients in primary care. *Fam Pract*. 2000;17(2):159–166. doi:10.1093/FAMPRA/17.2.159
12. Megari K. Quality of life in chronic disease patients. *Health Psychol Res*. 2013;1(3):27. doi:10.4081/HPR.2013.E27
13. Shofany C. Quality of life among chronic disease patients. *Nurs Care Open Access J*. 2017;4(Issue 2). doi:10.15406/NCOAJ.2017.04.00103
14. Goh SGK, Rusli BN, Khalid BAK. Development and validation of the Asian diabetes quality of life (AsianDQOL) Questionnaire. *Diabet Res Clin Pract*. 2015;108(3):489–498. doi:10.1016/j.diabres.2015.02.009
15. Permana H, Liem MV, Soetedjo NNM. Validation of the Indonesian version of the asian diabetes quality of life Questionnaire. *Acta Med Indones*. 2021;53(2):143.

16. Endokrinologi Indonesia pedoman pengelolaan dan pencegahan diabetes melitus tipe P. *Pedoman Pengelolaan Dan Pencegahan Diabetes Melitus Tipe 2 Dewasa Di Indonesia-2021 Perkeni I Penerbit Pb Perkeni*.
17. Febriyanti RM, Irawan AA, Anggriani N, et al. Challenges in implementing Indonesia's community-based chronic disease management program (Prolanis): a scoping review. *AIMS Public Health*. 2025;12(3):890–915. doi:10.3934/PUBLICHEALTH.2025045
18. Wulandari RD, Laksono AD, Mubasyiroh R, Rachmalina R, Ipa M, Rohmah N. Hospital utilization among urban poor in Indonesia in 2018: is government-run insurance effective? *BMC Public Health*. 2023;23(1):92. doi:10.1186/S12889-023-15017-Y
19. Larasati TA. Kualitas Hidup Pasien Diabetes Melitus Tipe 2 Di Rs Abdul Moeloek Propinsi Lampung. *Jurnal Kedokteran Dan Kesehatan Universitas Lampung*. 2012;17–20.
20. Dan Debora Tampongangoy Jurusan Keperawatan Poltekkes Kemenkes Manado JM L. Gambaran Kualitas Hidup Pasien Diabetes Mellitus Di Poliklinik Endokrin Rsup Prof. *Dr R D KANDOU MANADO*.
21. Umam MH, Purnama D, Solehati T. Gambaran Kualitas Hidup Pasien Dengan Diabetes Melitus Di Puskesmas Wanaraja. *Jurnal Kesehatan Kusuma Husada*. 2020;70–80. doi:10.34035/JK.V11I1.419
22. Pengukuran Kualitas Hidup Pasien Program Pengelolaan Penyakit Kronis Diabetes Melitus Tipe 2 Di Puskesmas Tamalanrea Makassar | Fajriansyah | Majalah Farmasetika. Available from: https://jurnal.unpad.ac.id/farmasetika/article/view/25886/12463. Accessed April 17, 2025.
23. World Health Organization. Regional Office for the Western Pacific. The Asia-Pacific perspective: redefining obesity and its treatment. Sydney: Health Communications Australia; 2000. Available from: https://iris.who.int/handle/10665/206936. Accessed November 20, 2025.
24. Cheng Q, Fattah RA, Susilo D, et al. Determinants of healthcare utilization under the Indonesian national health insurance system - a cross-sectional study. *BMC Health Serv Res*. 2025;25(1):48. doi:10.1186/S12913-024-11951-8/TABLES/6
25. Flatz A, Casillas A, Stringhini S, Zuercher E, Burnand B, Peytremann-Bridevaux I. Association between education and quality of diabetes care in Switzerland. *Int J Gen Med*. 2015;8:87–92. doi:10.2147/IJGM.S77139
26. Permana H, Koesoemadinata RC, Soetedjo NNM, et al. Diabetes mellitus patients in Indonesia: management in a tertiary hospital compared to primary health care. *Universa Med*. 2022;41(2):157–168. doi:10.18051/univmed.2022.v41.157-168
27. Jöonsson AC, Lindgren I, Norrving B, Lindgren A. Weight loss after stroke. *Stroke*. 2008;39(3):918–923. doi:10.1161/STROKEAHA.107.497602
28. Scherbakov N, Dirnagl U, Doehner W. Body weight after stroke lessons from the obesity paradox. *Stroke*. 2011;42(12):3646–3650. doi:10.1161/STROKEAHA.111.619163/ASSET/FF3A6C86-4D48-4261-9720-C2F94570850E/ASSETS/GRAPHIC/ZHS0121162480002.JPEG
29. Diaz LA, Gupta V. Diabetic amyotrophy. *StatPearls*. 2023. Available from: https://www.ncbi.nlm.nih.gov/books/NBK560491/. Accessed June 8, 2025.
30. Muhammad F. Kualitas Hidup Pasien Diabetes Melitus Tipe 2 dan Faktor Risiko Kualitas Hidup yang Dinilai Berdasarkan Kuesioner Asian Diabetes Quality of Life versi Indonesia di Rumah Sakit dr. Hasan Sadikin Bandung. *Universitas Padjadjaran*. 2022.
31. Chung JO, Cho DH, Chung DJ, Chung MY. Assessment of factors associated with the quality of life in Korean type 2 diabetic patients. *Intern Med*. 2013;52(2):179–185. doi:10.2169/internalmedicine.52.7513
32. Al Kaabi MSK, Al Kaabi BK, Al Marzooqi FM, Al Murri SG, Baynouna Al Ketbi LM. Evaluation of health-related quality of life in patients with diabetes in different care settings a cross sectional study In Alain, Uae. *medRxiv*. 2021. doi:10.1101/2021.06.19.21259165
33. Cornell S. Managing diabetes-related costs and quality of life issues: value of insulin analogs and pens for inpatient use. *Health Policy*. 2010;96(3):191–199. doi:10.1016/J.HEALTHPOL.2010.02.006
34. Oyefabi AM, Oyefabi BO, Ejembi C, Onajole AT, Ogunsina MA, Nwankwo B. Mean quality of life of hypertensive and diabetic patients: a comparative study of patients in secondary and tertiary health facilities in Kaduna State, Nigeria. *Niger Postgraduate Med J*. 2023;30(2):167–174. doi:10.4103/NPMJ.NPMJ_5_23