

# Health-Related Quality of Life Using EQ-5D-3L Utility Score Among Type 2 Diabetes Patients: Experiences from Tigray Region, Northern Ethiopia

Hiluf Kalayou Haftu<sup>1</sup>, Damen Hailemariam<sup>2</sup>, Berhan Tassew<sup>2</sup>, Zenawi Hagos Gufue<sup>3</sup>, Woldu Aberhe<sup>4</sup>

<sup>1</sup>Department of Curative and Rehabilitative Services, Health Care Reforms, Tigray Regional Health Bureau, Tigray, Ethiopia; <sup>2</sup>Department of Reproductive Health and Health Services Management, School of Public Health, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia; <sup>3</sup>Department of Public Health, College of Medicine and Health Sciences, Adigrat University, Tigray, Ethiopia; <sup>4</sup>Department of Adult Health Nursing, School of Nursing, College of Health Sciences, Aksum University, Tigray, Ethiopia

Correspondence: Hiluf Kalayou Haftu, Email [hilufk2021@gmail.com](mailto:hilufk2021@gmail.com)

**Purpose:** To assess the health-related quality of life and associated factors among type 2 diabetic patients in Ayder Comprehensive Specialized Hospital, Northern Ethiopia, 2019.

**Patients and Methods:** A hospital-based cross-sectional study was conducted among 415 type 2 diabetic patients coming to receive their routine outpatient follow-up service during the study period, from January 1, 2019, to March 31, 2019, in Ayder Comprehensive Specialized Hospital, Northern Ethiopia. The EQ-5D-3L instrument was used to assess the patients' self-reported health status and a multivariable ordinal logistic regression model was used to determine the independent factors associated with the health-related quality of life and P-value <0.05 was used to declare statistical significance.

**Results:** The total mean quality of life score was  $0.73 \pm 0.23$  with the total quality-adjusted life year of 2172.60 per life years and an average of 7.4 years of follow-up with type 2 diabetic treatments. Quality of life of type 2 diabetic patients with level two and three anxious patients were 77% and almost three times more likely to be affected than level one anxious patients (AOR = 1.77; 95% CI 1.23–1.86) and (AOR = 2.74; 95% CI 1.24–2.84) respectively. Older age, occupational status, lower monthly income, long waiting time, and presence of diabetic complications were significantly associated with impaired health-related quality of life.

**Conclusion:** The results of this study revealed a relatively low health status among type 2 diabetic patients. Quality of life of type 2 diabetic patients was mostly affected in the anxiety and depression component. It could be worthwhile if hospitals assign psychiatric professionals for the regular and effective counseling of diabetic patients.

**Keywords:** diabetes mellitus, health-related quality of life, utility, EQ-5D-3L, Tigray

## Introduction

The overall prevalence of Type 2 Diabetes Mellitus (T2DM) has increased and the substantial human suffering is staggering.<sup>1</sup> It occurs all over the world and in 2000 the global prevalence of diabetes mellitus was 2.8%, this is estimated to be projected to 4.4% in 2030. The number of people suffering from diabetes mellitus is increasing globally and this is projected to rise from 171 million in 2000 to 366 million in 2030.<sup>2</sup>

According to the International Diabetes Federation (IDF) report, the highest prevalence rate of T2DM occurred in low- and middle-income countries (LMICs). In this region, about 32.8 million (12.5%) of adults aged 20–79 years had diabetes in 2011 and this number is expected to double in less than 20 years.<sup>3</sup> Estimates from the 2014 IDF report suggest that the number of adults with T2DM in sub-Saharan Africa increased by 98%, from 12.1 million in 2010 to 23.9 million in 2030. Impaired glucose tolerance in Sub-Saharan Africa is expected to rise by 75.8%, from 26.9 million in 2010 to 47.3 million in 2030.<sup>4</sup>

In Ethiopia, T2DM is becoming a public problem and affects all age groups which leads to health, economic, and social crisis. The overall prevalence of T2DM is estimated at 6.5% and 6.6% among men and women, respectively.<sup>5</sup> Ethiopia is one of the countries in which most of the populations are young adults, and according to some studies carried out the prevalence of T2DM among the young age group was about 8.9%.<sup>6</sup> Ethiopia is the second most populous nation in Africa following Nigeria, with over 115 million people and the country is one of the poorest countries in Sub-Saharan Africa, with a per capita gross national income of \$890 per year.<sup>7</sup>

T2DM has an impact on lowering the quality of life of patients with and without complications and its impact is slightly lower than individuals of similar age in the general population with women 0.81 and men 0.78, respectively.<sup>8</sup> It has a chronic effect in which patients extensively suffer mentally, physically, socially, and economically. Diabetic complications have an association with lowering the quality of life in diabetic patients as compared with non-diabetic patients. Foot ulcer has an impact of lowering the quality of life by 0.92 in physical endurance, 0.87 in the dimension of role limitation, and 0.82 lower in physical endurance in patients aged 50–59 as compared to patients less than 50.<sup>9</sup>

In terms of health expenditure, the direct and indirect cost of T2DM care is estimated to be \$98 billion. The direct costs are estimated at \$44 billion (including \$27.5 billion for inpatient hospital care and \$5.5 billion for nursing home care). The indirect costs \$54 billion, including \$37.1 billion for disability and \$16.9 billion attributed to mortality. The indirect costs are related to the loss of productivity and loss of quality of life.<sup>10</sup>

Even though data are scarce in Ethiopia regarding the Health-Related Quality of Life (HRQoL) of T2DM patients, diabetic patients are facing a highly impaired HRQoL. To the best level of our knowledge, the HRQoL among T2DM patients is not yet explored in detail in the study area and this study aimed to assess the HRQoL and associated factors of T2DM patients attending the Ayder Comprehensive Specialized Hospital, Northern Ethiopia.

## Patients and Methods

### Study Setting

The study was conducted in Ayder Comprehensive Specialized Hospital, Northern Ethiopia; the hospital is located 783 kilometers away from Addis Ababa, the capital city of Ethiopia. The hospital has a medical outpatient department that provides referral and follow-up services for more than one thousand diabetic patients and the study was conducted from January 1, 2019, to March 31, 2019.

### Study Design and Participants

A hospital-based cross-sectional study was conducted among T2DM patients (who visited the diabetic clinic for at least 6 months) consecutively coming to receive their routine outpatient follow-up service to the diabetic clinic of Ayder Comprehensive Specialized Hospital until the required sample size was obtained were included in this study, but pregnant type 2 diabetic patients were excluded from the study.

### Sample Size Determination

The sample size for the study was calculated using a single population proportion formula with the following assumptions; in order to get a maximum sample size, the standard deviation of HRQoL among type 2 diabetic patients was taken (–0.5), 5% margin of error, and 95% confidence level, accordingly the calculated sample size was 384, and with an estimated 10% non-response rate, the final sample size was 427.

## Study Variables

### Outcome Variable

Health-related quality of life (perfect, higher, moderate, and lower health status).

### Independent Variables

Socio-demographic characteristics, duration of therapy, type of therapy, obesity, diabetic complications, and health services related variables.

## Operational Definitions

### Health-Related Quality of Life

The overall impact of a medical condition on the physical, mental and social well-being of an individual. It has different cut-off point values ranging from 1 to 0. Perfect health is 1 and death is 0, the cutoff point for higher health states is from 0.835 to 1, moderate health states value ranges from 0.681 to 0.835, lower health states value ranges from 0 to 0.681, and health states less than 0 are considered conditions worsen than death.<sup>11</sup>

## Data Collection Tool and Process

The HRQoL was assessed using an interviewer-administered three-level version of the European quality of life five-dimension scale (EQ-5D-3L) and the European quality visual analog scale (EQ-VAS) questionnaires. The EQ-5D-3L instrument is a widely used preference-based outcome measure in the type 2 diabetes context, recent studies suggested that the EQ-5D-3L is simple, easy to apply with reasonable validity,<sup>12</sup> reliability,<sup>13</sup> and responsiveness in type 2 diabetes.<sup>14</sup>

The EQ-5D-3L is a descriptive system that classifies a health state into three levels (no problem, (level 1), some/moderate problems (level 2), and severe/extreme problems (level 3)) and on five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression.<sup>15</sup> The EQ-5D-3L questionnaire was used and reproduced with permission from the EuroQol Research Foundation,<sup>15</sup> and the organization also provided the Ethiopian local translated version of the data collection tool. The EQ-5D-3L has seldom been used in Ethiopia, there was no reference value set, all the possible health states were valued by a general reference population of Zimbabwe tariff<sup>16</sup> were adopted since both countries are in the low-income region of sub-Saharan Africa. Data quality was assured by proper training of data collectors and through regular supervision of the data collection process by the principal investigator.

## Data Processing and Analysis

The collected data was coded and checked for its consistency and completeness up to the end of each data collection period. Epi Info version 7.2.4.0 software was used for data entry. The entered data were exported to STATA version 14.0 for windows. Descriptive statistics of numeric variables were presented in mean and standard deviations and categorical variables were presented using frequency and percentages. The mean utility (EQ-5D-3L and EQ-VAS scores) was determined by the multiplicative assumption theory and a 3.5% discount rate for Quality-adjusted life years (QALY) was used.

The bivariate analysis was done to check the existence of crude association and to select candidate variables, those variables which were clinically important and having ( $P < 0.25$ ) were included in the final model. A multivariable ordinal logistic regression model was used to determine the independent factors associated with the quality of life and assumptions of multicollinearity, interaction and model fitness were checked. The summary measures of estimated crude (COR) and adjusted odds ratios (AOR) with 95% CI were presented and  $P < 0.05$  was used to declare statistical significance. Finally, the results were presented in statements, tables, and figures.

## Results

### Socio-Demographic Characteristics

A total of 427 patients were approached for this study, among these 415 T2DM patients had completed questionnaires making the response rate 97.2%. Out of the total 415 T2DM patients who participated in the study, 143 (34.5%) of them were above the age of 60 years, and females account for 217 (52.3%) of the patients. The study participants had an average of 7.4 follow-up years with type 2 diabetes treatments (Table 1).

### Health Service-Related Characteristics

The monthly income of the diabetic patients shows that 164 (39.5%) of the patients had earned less than \$70.40 and 103 (24.8%) of type 2 diabetic patients had traveled more than 7.5 kilometers to access the health service (Table 2).

**Table 1** Socio-Demographic Characteristics of Type 2 Diabetic Patients Receiving Routine Follow-Up Service in Ayder Comprehensive Specialized Hospital, Northern Ethiopia, 2019 (n = 415)

Patient Profile	Categories	Frequency	Percentage (%)
Age (in years)	<30	35	8.4
	30–40	53	12.8
	40–50	91	21.9
	50–60	93	22.4
	>60	143	34.5
Gender	Female	217	52.3
	Male	198	47.7
Marital status	Single	26	6.3
	Married	306	73.7
	Widowed	51	12.3
	Divorced	32	7.7
Educational status	Unable to read and write	150	36.2
	9–10	67	16.1
	11–12	57	13.7
	Diploma and above	141	34.0
Occupational status	Governmental employee	133	32.0
	Un-employed	85	20.5
	Merchant	57	13.7
	Student	20	4.8
	Farmer	50	12.0
	Private employee	70	17

## HRQoL Using EQ-5D-3L Utility Scores

The study population had a total of 2146.1 QALY per life years and they had reported an average EQ-5D-3L utility score of  $0.73 \pm 0.23$ . Patients with a longer duration of diabetes had reported a 0.78 HRQoL, quality of life for type 2 diabetic patients was mostly affected in the anxiety and depression component with the mean value of  $0.65 \pm 0.23$ . Quality of life of type 2 diabetic patients with level two and three anxious patients were 77% and almost three times more likely to be affected than level one anxious patients (AOR = 1.77, 95% CI 1.23–1.86) and (AOR = 2.74, 95% CI 1.24–2.84) respectively (Table 3).

## Decomposition of EQ-5D-3L Quality-of-Life Scores

According to the EQ-5D-3L dimensions, mobility classification level shows that 291, 105, and 19 adult diabetic patients had levels one, two, and three, respectively. The self-care level of classification shows that 284, 100, and 31 adult diabetic patients had levels one, two, and three, respectively (Figure 1). The frequency of problems varied between the EQ-5D-3L dimensions. Problems with mobility, usual activities, and pain were less frequent, and problems with anxiety or depression components were frequently reported (Figure 2).

**Table 2** Health Service Characteristics of Type 2 Diabetic Patients Receiving Routine Follow-Up Service in Ayder Comprehensive Specialized Hospital, Northern Ethiopia, 2019 (n = 415)

Characteristics	Categories	Frequency	Percentage (%)
Affordability (Monthly income in USD <sup>§</sup> )	<70.4	164	39.5
	70.4–156.4	142	34.3
	156.4–312.8	81	19.5
	>312.8	28	6.7
Accessibility (distance in kilometer)	1–2.5	67	16.1
	2.5–5	145	35
	5–7.5	100	24.1
	>7.5	103	24.8
Waiting time (In minutes)	<30	18	4.4
	30–60	73	17.6
	60–90	135	32.5
	>90	189	45.5
Treatment cost (In USD)	< 4.7	160	38.5
	4.7–6.3	41	9.9
	6.3–7.8	30	7.2
	>7.8	184	44.4

**Notes:** <sup>§</sup>United States Dollar, 1 USD= 31.9609 according to the national bank of Ethiopia exchange rate dated from March 30, 2019.

The health-related quality of life of patients with complications was slightly lower than individuals without complications. The type of therapy taken by patients had a different scale of quality of life. Patients who take both oral and injection therapy had the lowest quality of life with a mean score of 0.77 as compared with a mean score of oral therapy 0.86 and injection therapy 0.78, respectively, and the average score assigned to EQ-VAS by people with type 2 diabetes was 87.4. The quality-of-life scores among type two diabetic patients using the EQ-5D-3L utility score shows diabetic patients in the age group of 20–30 years have a mean and standard deviation score of  $0.7 \pm 0.34$ , whereas according to the EQ-VAS score their mean and standard deviation score of  $93 \pm 6.5$  (Table 4).

According to the ordinal logistic regression model, the quality of life of type 2 diabetic patients showed that mobility has a significant association with increasing age and self-care had a significant association with educational status. After controlling the effect of all other confounders, diabetic patients with the age group of 40–50 had 85% less HRQoL utility score as compared to those below the age of 20 years (AOR = 0.15; 95% CI 0.03–0.49). Similarly, private employee diabetic patients had 69% less HRQoL utility score than government employees (AOR = 0.31; 95% CI 0.19–0.48).

Similarly, patients who with a monthly income of \$70.4 to 156.4 had 44% less HRQoL utility score than patients with monthly income less than \$70.4 (AOR = 0.56; 95% CI 0.46–0.62). Similarly, diabetic patients who stayed for taking service for more than 90 minutes had 31% less HRQoL utility score than patients who stayed for less than 30 minutes (AOR = 0.69; 95% CI 0.49–0.98). Finally, type 2 diabetic patients with complications had 25% less HRQoL utility score than patients with no complications. The average EuroQol-VAS score in this population was 86.4 with 95% CI (83.8, 90.9). EQ-5D-3L utility and EuroQol-VAS scores had no significant association with EQ-VAS (Table 5).

**Table 3** The Association Between Health Dimensions and Total utility<sup>1</sup> Among Type 2 Diabetic Patients Receiving Routine Follow-Up Service in Ayder Comprehensive Specialized Hospital, Northern Ethiopia, 2019 (n = 415)

EQ-5D-3L Dimensions		HRQoL (the Mean Score of Participants was 0.73 Which is Lower QoL than Cut Point 0.8)		
		AOR	95% CI	P-value
Mobility	I have no problem with mobility	Ref (1)		
	I have some problem in walking	0.9	0.50–1.63	0.73
	I am confined to bed	2.31	0.57–9.37	0.24
Self-care	I have no problem	Ref (1)		
	I have some problem in washing myself	0.89	0.46–1.71	0.73
	I am unable to wash or dress myself	0.21	0.07–0.66	0.01**
Usual activities	I have no problem to perform	Ref (1)		
	I have some problems performing activities	0.63	0.31–1.28	0.20
	I am unable to perform my usual activities	0.67	0.24–1.89	0.45
Pain/ discomfort	I have no pain	Ref (1)		
	I have some pain/discomfort	1.77	0.87–3.61	0.12
	I have extreme pain/ discomfort	0.74	0.22–2.54	0.63
Anxiety/depression	I am not anxious/ depressed	Ref (1)		
	I am moderately anxious/ depressed	1.77	1.23–1.86	0.02**
	I am extremely anxious/ or depressed	2.74	1.24–2.84	0.04**

**Notes:** <sup>1</sup>According to the EQ-5D Euroqol subscales. \*\*=shows a statistically significant difference at P < 0.05. Reproduced by permission of EuroQol Research Foundation.<sup>15</sup>

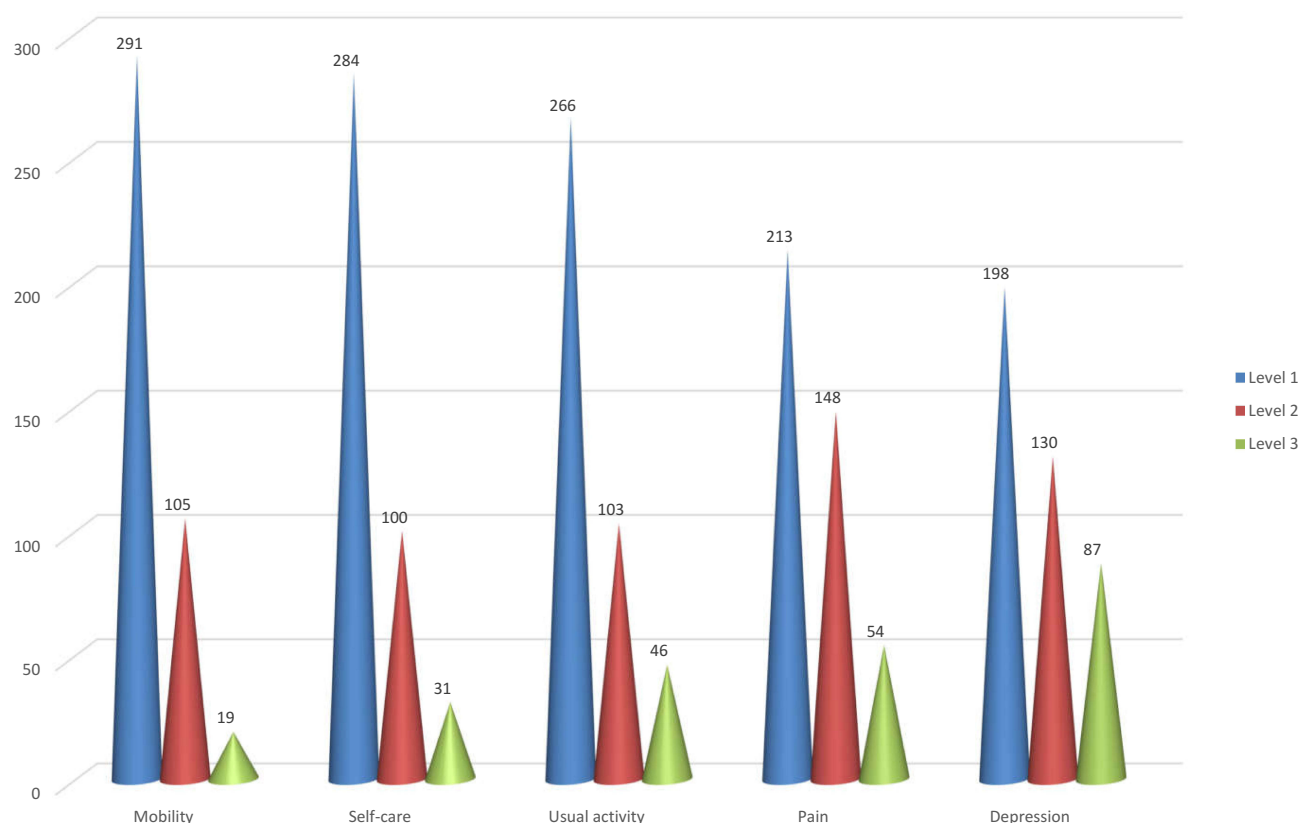
**Abbreviations:** AOR, adjusted odds ratio; HRQoL, Health-Related Quality of Life; QoL, Quality of life; EQ-5D-3L, three-level European quality of life five-dimension; Ref, reference group; CI, confidence interval.

## Discussion

This study was aimed at using EQ-5D-3L to evaluate the health status of T2DM patients in a tertiary health-care facility, as well as determining the factors associated with EQ-VAS score and utility valuations. The findings showed that the mean health status of respondents was 0.73 which was a relatively low health status when compared with the Zimbabwean population norms. The results indicate that T2DM patients in the study valued their health lower than the Zimbabwean general population which was 0.842.<sup>16</sup> Perhaps the observed variations were expected as the Zimbabwean study used the general population, who were not necessarily sick, while this study used type 2 diabetic patients. Differences in socioeconomic and health-care systems across the regions could be major contributors.

The finding of this study was also compared with the previous studies which used the EQ-5D-3L scale to determine HRQoL of patients with type 2 diabetes mellitus. In a study conducted in Enugu State, Nigeria,<sup>17</sup> the mean score of overall QoL was 0.72 in type 2 diabetic patients which was consistent with the finding of this study and this may be due to the poor socioeconomic status, and the socio-cultural status of the study populations.

The mean EQ-5D-3L score in the study participants was 0.71 which was lower than studies that used the same instruments in Norwegian,<sup>18</sup> UK,<sup>19</sup> Japanese,<sup>20</sup> Korean,<sup>21</sup> and patients with a mean score of 0.85, 0.851, 0.862, 0.9, and respectively. This could be due to the influence of socioeconomic and health-care systems-related factors. Some of these



**Figure 1** The frequency distributions of problems within the EQ-5D-3L dimensions of type 2 diabetic patients attending Ayder comprehensive specialized hospital, Northern Ethiopia, 2019 (n = 415).

differences could be due to differences in the main characteristics of study subjects such as; age, duration of diabetes, educational status, and the presence of long waiting time.

The finding of this study was also compared with the previous studies which used the EQ-5D-3L scale to determine HRQoL of patients with type 2 diabetic patients. In a study conducted in Shantou, China,<sup>22</sup> the mean score of overall QoL was 0.79 in type 2 diabetic patients which were higher than the finding of this study and this may be due to the sociocultural status of the study populations and perception of health as well as questions on the validated tool to get adequate information regarding the socio-economic, behavioral and cultural status of the study participants.

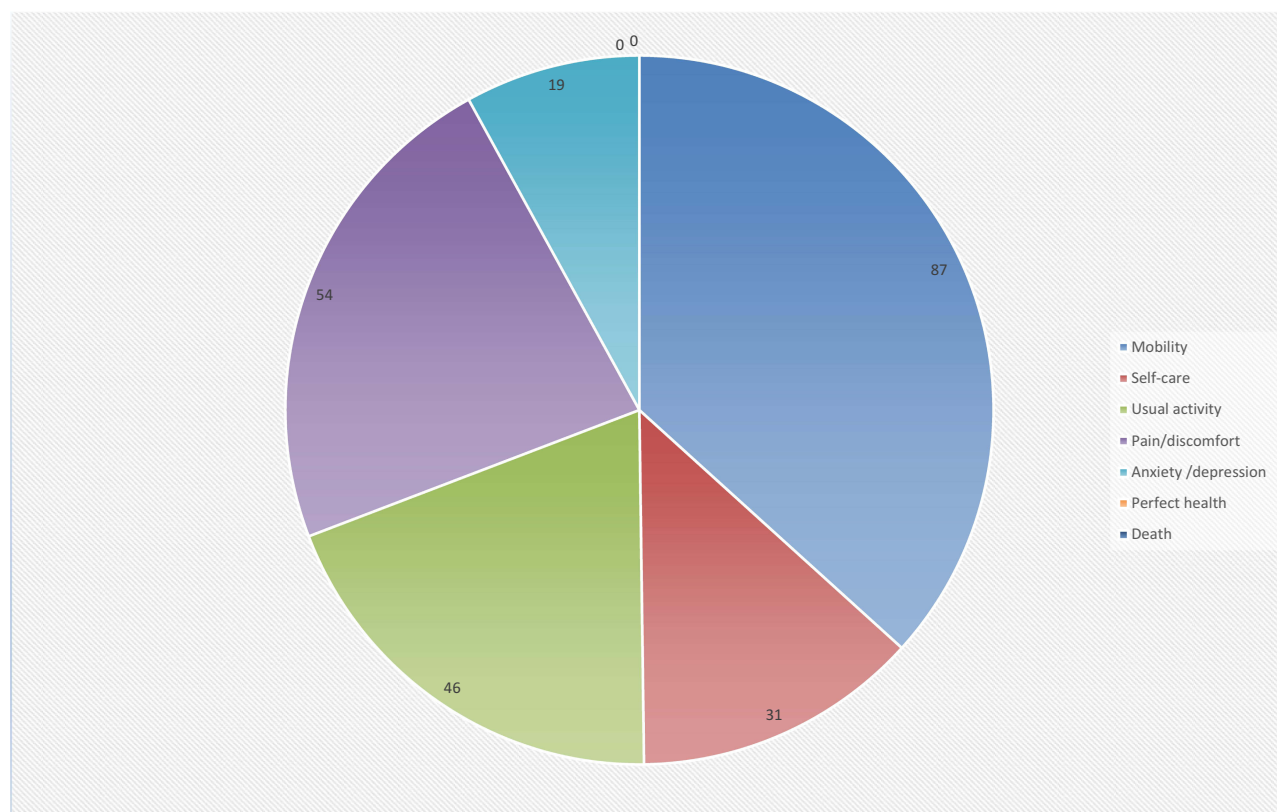
The impact of diabetes on HRQoL in type 2 diabetic patients follow in the present study is higher than from the type 2 diabetic patients in Bangladesh.<sup>12</sup> This may be due to societies' better awareness of seeking medical attention and early diagnosis until other incapacitating symptoms had developed, this may be due to easily accessible for health services, and a short waiting time in the health services than Bangladesh.

Among the five domains of HRQoL, study participants had the lowest mean score (0.65) on the anxiety or depression component in this study which had a similar finding with a study conducted in Catalonia in which type 2 diabetic patients were more likely to report moderated or severe problems in four of the five dimensions of EQ-5D.<sup>22,23</sup>

Individuals with type 2 diabetic patients who had completed high school, preparatory, and above had a HRQoL score of 0.8, 0.82, and 0.85 which was higher than those who had no education (0.76). The finding of the study conducted in Ethiopia, felege Hiwot Hospital<sup>24</sup> on QoL also showed that HRQoL was better in type 2 diabetic patients who had higher educational status. This could be due to a better ability to decide on self-care, a better understanding of the disease, its complication, and treatment.

Patients who were living with type 2 diabetic patients for more than five years had worse HRQoL as compared with those who live with it for five years and less. This relationship between QoL and the duration of diabetic patients was





**Figure 2** The severity distribution for the worst health state in each dimension according to the EQ-5D-3L subscales for type 2 diabetic patients attending Ayder comprehensive specialized hospital, Northern Ethiopia, 2019 (n = 415).

demonstrated in previous studies. A study conducted among type 2 diabetic patients in Ethiopia<sup>24</sup> showed that the long duration of diabetes mellitus had a negative influence on the QoL of patients.

This study had observed a significant association between age, occupation, monthly income, and HRQoL of patients. It had demonstrated that patients with type 2 diabetic patients who were aged, unemployed, and with low income had worse QoL. The negative effect of aging, low economic status, and unemployment of type 2 diabetic patients on HRQoL had been reported in previous studies.<sup>12,22</sup> This study has also tried to analyze the association between HRQoL and health services characteristics. The length of stay for receiving services has the most significant effect in lowering the quality of life for the patients in the present study.

Distance traveled to get access to the hospital affected the third dimension of EQ-5D with a significant association. This finding was comparable with the previous studies which used the EQ-5D scale to determine HRQoL of patients with DM and analyze the association between health service characteristics. A study conducted in the United Kingdom (UK) Primary Medical Care Group, Faculty of Health Medicine and Biological Sciences, University of Southampton showed that long waiting time and the long appointment had a significant association with reducing the health-related quality of life for type 2 diabetic patients and finding of the current study shows similar outcome.<sup>25,26</sup>

The ordinal logistic regression analysis was used to determine factors associated with problems in each EQ-5D dimension. Ordinal logistic regression analysis resulted in a model containing diabetic complications that had a significant association with the quality of life. This finding can be compared with the previous studies which used the EQ-5D scale to determine HRQoL of type 2 diabetic patients. A study conducted in Dutch,<sup>8</sup> Iran,<sup>3</sup> Ethiopia,<sup>24</sup> Brazil,<sup>27</sup> and China<sup>22</sup> showed that the presence of diabetic complications affects QoL.

EQ-5D utility and EuroQol-VAS scores have no significant Association with EQ-VAS, the EQ-5D utility, and EuroQol VAS scores are correlated. This finding is comparable with the previous studies which determine the association



**Table 4** Quality of Life Score Among Type 2 Diabetic Patients Attending Ayder Comprehensive Specialized Hospital, Northern Ethiopia, 2019 (n = 415)

Patient Profile	Categories	EQ-5D-3L Utility Score	EQ-VAS (0–100)
		Mean (Standard Deviation)	Mean (Standard Deviation)
Age (in years)	<20	0.76 ± 0.47	95.0 ± 4.7
	20–30	0.70 ± 0.34	93.0 ± 6.5
	30–40	0.83 ± 0.29	90.8 ± 8.41
	40–50	0.81 ± 0.24	87.5 ± 10.3
	50–60	0.88 ± 0.18	83.7 ± 10.1
	>60	0.72 ± 0.23	81.9 ± 10.7
Gender	Female	0.82 ± 0.26	87.5 ± 11.7
	Male	0.81 ± 0.25	86.4 ± 11.1
Marital status	Married	0.81 ± 0.25	86.2 ± 10.5
	Widowed	0.88 ± 0.17	82.8 ± 10.4
	Divorced	0.77 ± 0.25	79.7 ± 10.2
Educational status	9–10	0.78 ± 0.26	86.3 ± 10.3
	11–12	0.80 ± 0.26	87.8 ± 8.7
	higher education	0.84 ± 0.27	89.8 ± 10.7
Monthly income (In USD)	156.4–312.8	0.75 ± 0.29	87.5 ± 10.9
	>312.8	0.77 ± 0.28	87 ± 6.2
Distance traveled (in kilometer)	2.5–5	0.79 ± 0.25	86.1 ± 10.3
	5–7.5	0.79 ± 0.27	87.2 ± 8.8
	>7.5	0.87 ± 0.18	83.7 ± 11.5
Waiting time (in minutes)	30–60	0.74 ± 0.29	87.5 ± 8.5
	60–90	0.78 ± 0.25	85.9 ± 10.7
	>90	0.87 ± 0.20	84.7 ± 11.2
Payment (in USD)	4.7–6.3	0.75 ± 0.30	87.3 ± 10.5
	6.3–7.8	0.80 ± 0.23	91.8 ± 5.1
	>7.8	0.79 ± 0.27	85.1 ± 10.8
Duration (in years)	6–10	0.78 ± 0.28	86.4 ± 9.8
	11–15	0.85 ± 0.20	82.6 ± 9.8
	>15	0.81 ± 0.23	80.1 ± 12.3
Complication	Yes	0.81 ± 0.26	84.7 ± 10.9
Obesity	Yes	0.85 ± 0.22	83.6 ± 10.7

**Abbreviations:** EQ-5D-3L, The three-level version of the European quality of life five-dimension scale, EQ-VAS, The European quality visual analog scale.

**Table 5** Factors Associated with the EQ-5D-3L Utility score<sup>1</sup> for Quality of Life Among Type 2 Diabetic Patients Attending Ayder Comprehensive Specialized Hospital, Northern Ethiopia, 2019 (n = 415)

Patient Profile	Utility	AOR	95% CI	P-value
Age (in years)	<20	Ref (1)		
	20–30	0.36	0.01, 0.25	0.04**
	30–40	0.61	0.01, 0.26	0.02**
	40–50	0.15	0.03, 0.49	0.03**
	50–60	0.97	0.05, 0.82	0.01**
	>60	0.29	0.03, 0.99	0.05
Gender	Female	Ref (1)		
	Male	1.02	0.65, 1.59	0.94
Educational status	Unable to read and write	Ref (1)		
	9–10	0.67	0.35, 1.29	0.24
	11–12	0.65	0.33, 1.29	0.22
	Higher education	0.95	0.48, 1.87	0.87
Occupational status	Governmental employee	Ref (1)		
	Un-employee	0.78	0.39, 0.56	0.05
	Merchant	0.89	0.48, 0.64	0.07
	Student	0.02	0.66, 0.83	0.02**
	Farmer	0.75	0.32, 0.76	0.05
	Private employee	0.31	0.19, 0.48	0.01**
Type of therapy	Oral	Ref (1)		
	Injection	1.04	0.62, 1.74	0.89
	Both	0.95	0.55, 1.65	0.86
Monthly income (in USD)	<70.4	Ref (1)		
	70.4–156.4	0.56	0.46, 0.62	0.03**
	156.4–312.8	0.36	0.30, 0.43	0.02**
	>312.8	0.49	0.27, 1.63	0.06
Distance (in kilometer)	< 2.5	Ref (1)		
	2.5–5	0.94	0.45, 1.96	0.87
	5–7.5	0.92	0.41, 2.07	0.84
	> 7.5	0.98	0.45, 2.10	0.95

(Continued)

Table 5 (Continued).

Patient Profile	Utility	AOR	95% CI	P-value
Waiting time (in minutes)	< 30	Ref (1)		
	30–60	0.38	0.28, 0.78	0.04**
	60–90	0.37	0.32, 0.71	0.03**
	>90	0.69	0.49, 0.98	0.04**
Payment (in USD)	< 4.7	Ref (1)		
	4.7–6.3	1.55	0.61, 3.98	0.36
	6.3–7.8	1.87	0.71, 4.91	0.21
	> 7.8	1.10	0.64, 1.88	0.73
Duration (in years)	< 6	Ref (1)		
	6–10	0.73	0.44, 1.20	0.21
	11–15	0.79	0.42, 1.49	0.47
	>15	0.72	0.32, 1.59	0.41
Complication	No	Ref (1)		
	Yes	0.75	0.60, 0.91	0.02**

Notes: <sup>1</sup>According to the EQ-5D Euroqol subscales. \*\*=shows a statistically significant difference at  $P < 0.05$ .

Abbreviations: AOR, adjusted odds ratio; EQ-SD-3L, Ref: reference group, CI, confidence interval.

between EQ-5D utility and EuroQol VAS scores. A study conducted for assessment of the health-related quality of life in Dutch<sup>8</sup> Patients with Type 2 diabetes showed that the EQ-5D utility and EuroQol-VAS scores correlated well.

This difference between these two studies may be due to low or high score on one scale did not necessarily mean a low or high score on the other scale because many patients with a relatively low EQ-5D utility score tended to report a moderate EuroQol-VAS score.<sup>3</sup> It could be worthwhile if hospitals assign psychiatric professionals for the regular and effective counseling of diabetic patients. Educational counseling programs would help diabetic patients to better understand their health status and treatment, thereby improve their treatment adherence and positive attitude toward diabetes.

## Conclusions

As a cross-sectional study, the observed associations in the present study may not necessarily be causal. In addition, data in this study were collected at a cross-section point period, and fluctuations may be likely if HRQoL is measured at multiple points in time. Nevertheless, despite the above limitations, the study has shown that the overall health-related quality of life among type 2 diabetic patients to below. In addition, age, income, educational status, occupation, duration of disease, and waiting time were seen to be significantly associated with health-related quality of life.

## Ethics Approval and Informed Consent

Ethical approval was obtained from the health research ethics review committee of Mekelle University (ERC 1319/2019). Written informed consent was obtained from all study participants, the data collected were handled with strong confidentiality, and stored anonymously. The study was conducted following the 1964 Declaration of Helsinki.

## Data Sharing Statement

The datasets generated and analyzed during the current study are available from the corresponding author on a reasonable request.

## Acknowledgment

The abstract of this paper was presented to the Addis Ababa University as a thesis talk with interim findings. The data is available in the institutional repository of Addis Ababa University available on <http://etd.aau.edu.et/bitstream/handle/123456789/20695/Hiluf%20Kalayu%20Haftu.pdf?sequence=1&isAllowed=y>.

## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; 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.

## Disclosure

The authors report no conflicts of interest in this work.

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