Journal of Advances in Medicine and Medical Research

Volume 37, Issue 1, Page 209-222, 2025; Article no.JAMMR.129827
ISSN: 2456-8899, NLM ID: 101711724
(Past name: British Journal of Medicine and Medical Research, Past ISSN: 2231-0614, NLM ID: 101570965)

A Cross-sectional Study of Health-related Quality of Life among Adults with Type 2 Diabetes on Treatment with Herbal and Conventional Glucose-lowering Agents in Nairobi, Kenya

Monicah Wanjiru Karara [a,b*], Faith Apolot Okalebo [b], Peter Ndirangu Karimi [b] and Sylvia Adisa Opanga [b]

[a] School of Pharmacy, Jomo Kenyatta University of Agriculture and Technology, Juja, Kenya, P.O. Box 62000-00200, Nairobi, Kenya.
[b] Department of Pharmacology, Faculty of Health Sciences, University of Nairobi, Nairobi, Kenya, P.O. Box 19676-00202, Nairobi, Kenya.

Authors' contributions

This work was carried out in collaboration among all authors. Authors MWK and FAO designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author PNK and SAO managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/jammr/2025/v37i15709

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/129827

Original Research Article

Received: 15/11/2024
Accepted: 17/01/2025
Published: 21/01/2025

**Corresponding author: E-mail: mkarara@jkuat.ac.ke, mkarara2007@gmail.com;*

Cite as: *Karara, Monicah Wanjiru, Faith Apolot Okalebo, Peter Ndirangu Karimi, and Sylvia Adisa Opanga. 2025. "A Cross-Sectional Study of Health-Related Quality of Life Among Adults With Type 2 Diabetes on Treatment With Herbal and Conventional Glucose-Lowering Agents in Nairobi, Kenya". Journal of Advances in Medicine and Medical Research 37 (1):209-22. https://doi.org/10.9734/jammr/2025/v37i15709.*

ABSTRACT

Background: Patients with type 2 diabetes often seek care from herbal clinics for glycemic control. The impact of herbal glucose-lowering therapies on quality of life in this patient population has not been studied adequately.

Aim: The study determined and compared health-related quality of life in patients with type 2 diabetes on treatment with herbal and conventional blood glucose-lowering agents in Nairobi, Kenya.

Methods: A cross-sectional study was conducted among 80 patients with type 2 diabetes attending a conventional clinic at Kenyatta National Hospital and 37 patients receiving care at New Life Herbal Clinic in Nairobi City County, Kenya. A general questionnaire was used to collect sociodemographic and clinical information from the study participants. The World Health Organization Quality of Life Brief Version questionnaire was used to assess the health-related quality of life in both groups. Descriptive data analysis was performed on all variables. The health-related quality of life scores were compared using the non-parametric Mann-Whitney test. Multiple linear regression analyses were used to identify the determinants of health-related quality of life. P-values equal to or less than 0.05 were considered to be statistically significant.

Results: Health-related quality of life scores in all the domains were significantly higher among the patients treated with conventional drugs compared to those treated at the herbal clinic ($p<0.001$). Patients in both groups had the highest scores in the social domain (median score: 66.67 [33.33-75] for herbal and 75 [75-97.92] for the conventional group). Among patients on herbal therapies, the lowest scores were on psychological aspect of HRQoL (45.83 [33.33-54.17]). Regarding overall quality of life, patients at Kenyatta National Hospital had significantly higher median scores (75 [75-100]) compared to those at the herbal clinic (50 [25-75], $p< 0.001$). Treatment with conventional glucose-lowering agents was associated with significantly higher HRQoL scores on all the domains ($p< 0.001$). Other factors associated with higher health-related quality of life scores were higher levels of education ($p=0.010$) and engagement in physical activity ($p=0.001$) for the physical domain; microvascular complications for the psychological domain ($p=0.010$) and male gender for the social domain ($p=0.037$).Additional factors associated with better environmental domain scores were male gender ($p=0.033$), older age ($p=0.004$), urban residence ($p=0.026$) and alcohol intake ($p=0.048$).

Conclusions: Patients on treatment with conventional therapies for type 2 diabetes had higher health-related quality of life scores compared to those on herbal treatments. We identified modifiable factors that can be enhanced to improve the quality of life of individuals with type 2 diabetes in both conventional and herbal treatment settings.

Keywords: Health-related quality of life; herbal; pharmacological; type 2 diabetes.

1. INTRODUCTION

Diabetes is a chronic disease affecting an estimated 537 million adults aged 20-79 years worldwide (Sun et al., 2022). According to the international Diabetes Federation (IDF), this number is projected to increase to 783 million by 2045. The most rapid increase is expected to occur in low and middle- income where 80% of patients with diabetes live (Sun et al., 2022). In 2021, the estimated prevalence of diabetes in Kenya was 3%, affecting approximately 821,500 adults (IDF,2021). In 2021, diabetes-related complications accounted for 5% of deaths occurring in people under 60 years of age in Kenya (Sun et al., 2022). Management of diabetes involves both lifestyle modifications and pharmacotherapy. In addition, self-management practices such as exercise, healthy diet and self-monitoring of blood glucose (SBMG) are recommended to improve diabetes treatment outcomes (ADA, 2022).

The goals of diabetes treatment are to achieve optimal glycemic control, relieve the signs and symptoms of hyperglycemia, prevent the occurrence and progression of microvascular and macrovascular complications and improve the patient's quality of life (Davies et al., 2018). The impact of these interventions is routinely assessed using objective measures of health such as blood glucose levels and lipid profiles along with morbidity and mortality attributable to diabetes (Elsayed et al., 2023). Diabetes and its treatment have the potential to affect the patient's quality of life in several ways. Diabetes-

related complications may lead to decreased mobility, pain and inability to carry out their daily activities (Oyewole et al., 2023). Other comorbid conditions may require additional treatment which further increases the treatment burden (Gruneir et al., 2016). Medical therapy, dialysis, and renal transplant may, for example, be required to treat end-stage renal failure in patients with type 2 diabetes (Jing et al., 2018). Other factors that may worsen quality of life in patients with type 2 diabetes include the complexities of diabetes treatment regimens, cost of medications, and adverse effects of drugs (Chang et al., 2023; Chaturvedi et al., 2018).

The World Health Organization (WHO) defines health as "a state of complete physical, mental, and social well-being—not merely the absence of disease, or infirmity" (World Health Organization, 2011). This definition implies that measurement of health and the effect of health interventions must not only include biomedical markers of health but also an estimation of the patients' well-being. While the laboratory tests and clinical examinations provide objective information on the effectiveness of health interventions, they do not measure how patients feel or are satisfied with their treatments. The effectiveness of health interventions and their effects on the patients' well-being are assessed by combining objective measures of health with patient reported outcomes such as health-related quality of life (HRQoL). Evaluation of HRQoL is important in chronic diseases such as type 2 diabetes because low HRQoL may have an impact on adherence to treatment and deterioration of clinical outcomes (Hand, 2016). HRQoL provides insights to the patients' perception regarding the impact of a disease and its treatment on their physical, psychological and social well-being. However, unlike the standard treatment outcomes, HRQoL and other patient-reported outcomes are not routinely monitored in care of patients with type 2 diabetes.

Patients with type 2 diabetes turn to herbal therapy for their diabetes control (Elsa et al., 2017; Yassin et al., 2016). This is driven by factors such as the belief that herbal medicines are totally safe, are more effective than conventional medicines and can cure diabetes. Herbal medicines are also easier to access since they do not require a prescription and are also more culturally acceptable (Elsa et al., 2017). Although several herbs have been reported to have glucose-lowering effects, there are no local guidelines for their use. Despite the widespread use of herbal medicines by type 2 diabetic patients in Kenya, studies on diabetes-related quality of life have focused on patients treated in conventional settings (Genga et al., 2014). Therefore, there exists a gap on this patient-reported outcome among patients with type 2 diabetes treated at the herbal clinics. This study compared the quality of life in patients treated for type 2 diabetes at Kenyatta National Hospital (KNH) and New Life Herbal Clinic (NLHC) in Nairobi City County, Kenya. The findings from this study will enable healthcare providers in both the conventional and herbal care settings to better understand the impact of conventional and herbal therapies on the patients' quality of life. Additionally, the study will identify factors that can be addressed to enhance quality of life in patients receiving care in herbal and conventional diabetes care settings.

2. MATERIALS AND METHODS

The methodology for recruitment and data collection on the sociodemographic and clinical characteristics of the patients who participated in this study has been described elsewhere (Karara et al., 2022)

2.1 Study Design and Setting

A facility-based cross-sectional study was conducted at Kenyatta National Hospital (KNH) and New Life Herbal Clinic (NLHC), a private herbal clinic in Nairobi County, Kenya between March 2019 and December 2021.

2.2 Study Population and Sampling Procedures

The population for this study were all adult outpatients with type 2 diabetes at the two study sites. Individuals were included in the study if they had received treatment and were on follow-up at the study sites for at least 6 months prior to this study. Patients with Type 1 and gestational diabetes were excluded from the study. The minimum sample size required at each study site was calculated as 66 patients. We increased this number to 73 patients per group to cater for a 10% non-response rate. Since there were few patients at the herbal clinic, we used an allocation ratio of one patient in the herbal clinic for every two patients recruited at KNH. A local study by Chege et al. on the safety and effectiveness of herbal antidiabetic medicines used a similar ratio of patients in the herbal and the conventional antidiabetic treatment arm

(Chege et al., 2020). Despite the unequal number of participants in the study arms, the researcher was able to demonstrate significant differences on glycated hemoglobin levels and adverse drug effects between patients on herbal antidiabetic treatments and those on conventional glucose lowering agents Consequently, we recruited 80 patients at Kenyatta National Hospital and 37 patients at the herbal clinic. Diabetic patients who met the study criteria were recruited consecutively during the clinic visits until the required sample size was achieved.

2.3 Data Collection on HRQOL

Patients were recruited into the study if they were over 18 years old, had a confirmed diagnosis of type 2 diabetes and had been receiving care at the study sites for at least six months. Individuals with other forms of diabetes, pregnant women and those with incomplete medical records were excluded from the study. Patients who were willing to participate in the study were requested to give informed consent. The World Health Organization Quality of Life Brief Version (WHOQOL-BREF, 2012 Revision) questionnaire was used to collect HRQoL data. The questionnaire has a total of 26 questions. Twenty-four questions (items) belong to 4 different domains (dimensions) of health namely; environmental (8 questions), physical (7 questions), psychological (6 questions) and social (3 questions). The remaining two questions assessed the patient's general QOL and health. One question asked about the individual's overall perception of HRQoL while the other evaluated the individual's general perception of his or her health. Each question had 5 Likert-type response options with scores ranging 1-5. Higher scores represented higher QOL (Harper et al., 1998). Data on the sociodemographic characteristics, diabetes duration, complications and comorbidities as well as types of antidiabetic treatments was obtained through face-to-face interviews and from patients files and recorded on a general questionnaire.

2.4 Statistical Analysis

The scores for the physical, psychological, social relationships and environmental domains were derived from the completed questionnaires. The other two items (questions 1 and 2) which assessed the overall quality of life and overall satisfaction with health were examined separately. The mean score of items within each domain were used to calculate the domain score. Mean scores were then multiplied by 4 to make domain scores comparable with the scores used in the WHOQOL-100. Where more than 20% of data was missing from an assessment, the assessment was discarded. Where an item was missing, the mean of other items in the domain was substituted. Where more than two items were missing from the domain, the domain score was not calculated (with the exception of domain 3, where the domain was only calculated if < 1 item was missing).

An SPSS syntax file that automatically checks, recodes data and computes domain scores was used in the computation of the HRQoL scores. The derived scores were then entered and analyzed using IBM SPSS package (SPSS 26.0, Chicago, IL). Summary statistics calculated included median scores and interquartile range for the various domains of health. P-values were obtained using the two-sample Mann-Whitney U test. Linear regression analysis was performed to identify the determinants of HRQoL in the two study groups. P-values less or equal to 0.05 were considered to be statistically significant.

3. RESULTS

A total of 80 participants were recruited from the KNH Endocrinology and Diabetes Outpatient Centre and 37 from the herbal clinic. A higher proportion of females were treated for type 2 diabetes at KNH (52, 65%) compared to the herbal clinic (13, 35.1%). Participants on conventional therapies were older (mean age: 62.31 ± 13.91 years) than those on herbal treatments (55.95 ± 13.99 years). Diabetes duration among participants on conventional therapies was longer (median: 10 [4–18] years) than that of those at the herbal clinic (3 [1–7] years). Only two (5.4%) participants at the herbal clinic owned a glucometer, and none had HbA1c test six months prior to the study. Comorbidities were more prevalent among participants on conventional therapy, with 65 (82.1%) individuals reporting multiple comorbidities (Table 1).

3.1 Glucose-Lowering Therapies Used at The Study Sites

The types of glucose-lowering agents used at the study sites have been described previously (Karara et al., 2022). Majority of the patients at KNH 67(83.8%) were on treatment with metformin. Half of the patients at this study site were on regimens containing insulin and oral

glucose-lowering agents (Table 2). Concurrent use of herbal and conventional antidiabetic treatments was reported in 17 (21.3%) of the participants from KNH.

The most frequently used herbs at NLHC were *Bidens pilosa* and *Rubia cordifolia*, which were employed in treatment of 14, (37.8%) patients each. Other herbs used at NLHC have been described in Fig. 2.

3.2 HRQOL Scores

Participants on conventional therapies for type 2 DM at KNH had significantly better HRQoL scores in all domains compared to their counterparts on herbal therapies (p< 0.001). Individuals in both groups had the highest scores in the social domain (Table 2). Among those on herbal therapies, the lowest scores were on the psychological aspect of HRQoL (45.83 [33.33-54.17]). Regarding overall quality of life, participants at KNH had significantly higher scores 75[75- 100] compared to those at the herbal clinic 50[25- 75]), (p< 0.001). Both groups had equal median scores on general health 75 [25-75].

3.3 Determinants of HRQOL

The results of bivariate and multivariable linear regression analysis on the determinants of physical and psychological HRQoL scores are presented in Table 3. Treatment with conventional antidiabetic therapies at Kenyatta National Hospital was associated with significantly higher physical health scores (1.48 scores, p<0.001). Higher education levels were associated with a 1.07 increase in physical health scores (p=0.010), and engaging in physical activity corresponded to a 1.32 improvement in this aspect of HRQoL (p=0.001). Psychological domain scores were 1.55 higher among participants using conventional therapies (p<0.001). The presence of microvascular complications was associated with 0.89 higher scores in the psychological domain (p=0.010).

Social domain scores were 1.56 higher among participants on conventional therapies (p<0.001). Male gender was significantly associated with a 1.52 increase in social domain scores on bivariate analysis. However, this effect was attenuated to 1.12 scores (p=0.037) in multivariable analysis. Treatment with conventional therapy was associated with a 1.45 increase in environment domain scores (p<0.001). Other factors associated with higher scores in the environment domain were male gender (1.08, p=0.033), urban residence (1.05, p=0.026), older age (0.96, p=0.004), and alcohol intake (0.93, p=0.048) (Table 4).

Table 1. Sociodemographic and clinical characteristics of study participants on treatment for type 2 diabetes at KNH and NLHC

Characteristic	Category	KNH (n=80) n (%)	NLHC (n=37) n (%)
Gender	Female	52 (65)	13 (35.1)
Age (years) (mean±SD)		62.31±13.91	55.95±13.99
Married	Yes	61 (76.3)	31 (83.8)
Highest education level	No formal education	16 (20)	1 (2.7)
	Primary	28 (35)	17 45.9)
	Secondary	30 (37.5)	13(35.1)
	Tertiary(college/university)	6 (7.5)	6 (16.2)
Body mass index (BMI)	<18.5 (underweight)	1 (1.3)	1 (2.7)
	18.6-24.9 (normal)	24 (30.0)	11 (29.7)
	>25(overweight/obese)	55 (68.7)	25 (67.6)
Alcohol history	Yes	25 (31.3)	28 (75.7)
Smoking history	Yes	11 (13.8)	21 (56.8)
Years with DM (median (IQR))		10[4-18]	3 [1-7]
Own glucometer	Yes	52 (65)	2 (5.4)
Previous (last 6 months) HbA1c	Yes	36 (45.0)	0 (0.0)
Complications	Microvascular	55 (68.8)	23 (62.2)
	Macrovascular	27 (33.8)	2 (5.4)
No. of comorbidities	None	0 (0.0)	3 (8.1)
	1	15 (18.8)	10 (27)
	>1	65 (82.1)	24 (64.9)

Table 2. Glucose lowering therapies used at KNH

Drug name	Category	KNH (n=80) n (%)
Biguanides	Metformin	67(83.8)
Sulfonylureas	Glibenclamide	3(3.8)
	Glimepiride	9(11.3)
	Gliclazide	3(3.8)
Insulin	Premixed	50(62.5)
	Long- acting	1(1.25)
Treatment regimens	Oral agents only	29(36.2)
	Insulin only	11(13.8)
	Insulin plus oral agents	40(50)
	Concurrent herbal and conventional therapy	17(21.3)

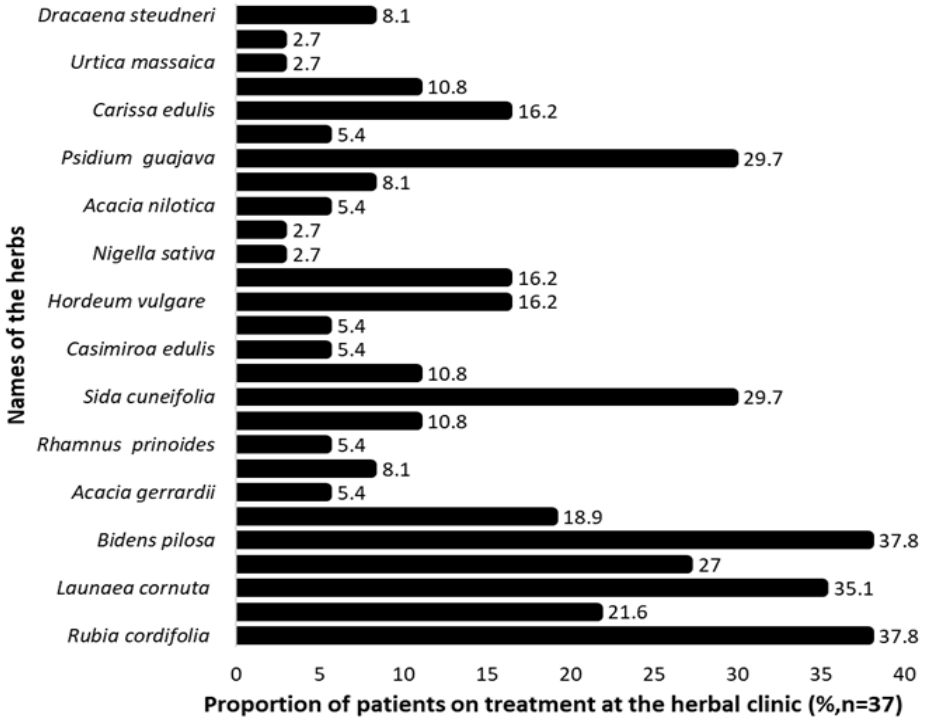

Fig. 1. Types of herbs used at NLHC (Adopted with permission from Karara et al., 2022

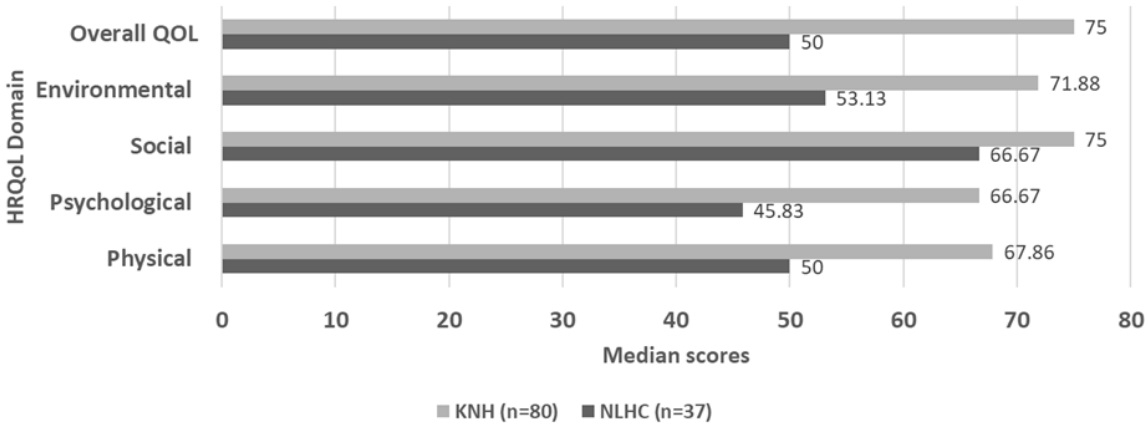

Fig. 1. Comparison of Median HRQoL domain scores at the study sites

Table 3. Bivariate and multivariable linear regression analysis of determinants of physical and psychological HRQoL among the study participants

Variables	WHOQOL–BREF DOMAINS							
	Physical				Psychological			
	Crude β (95% C.I)	P-value	Adj. β (95% C.I)	P-value	Crude β (95% C.I)	P-value	Adj.β (95% C.I)	P-value
Study site (KNH)	1.17 (0.78-1.76)	0.271	1.48 (1.36-1.62)	<0.001	1.44 (0.88-2.35)	0.105	1.55 (1.41-1.70)	**<0.001**
Gender (male)	1.11 (0.88-1.41)	0.469	-	-	1.02 (0.77-1.36)	0.979	-	-
Older Age	0.99 (0.92-1.06)	0.698	-	-	0.96 (0.88-1.04)	0.370	-	-
Marital status	0.99 (0.84-1.16)	0.836	-	-	1.03 (0.84-1.25)	0.985	-	-
Highest education level	1.10 (1.00-1.20)	0.081	1.07 (1.02-1.12)	0.010	1.03 (0.92-1.15)	0.416	-	-
Employment	0.97 (0.81-1.16)	0.713	-	-	1.08 (0.87-1.33)	0.496	-	-
Residence (urban)	1.03 (0.85-1.25)	0.823	-	-	1.04 (0.83-1.31)	0.795	-	-
Physical activity	1.13 (0.84-1.53)	0.441	1.32 (1.12-1.56)	0.001	0.93 (0.65-1.34)	0.911	-	-
Cigarette smoking	1.12 (0.89-1.41)	0.240	-	-	1.18 (0.89-1.56)	0.202	-	-
Alcohol intake	0.89 (0.75-1.06)	0.178	-	-	0.89 (0.72-1.09)	0.332	-	-
BMI	1.10 (0.96-1.25)	0.152	-	-	0.96 (0.82-1.12)	0.626	-	-
Duration with diabetes	0.99 (0.85-1.15)	0.818	-	-	0.99 (0.83-1.19)	0.818	-	-
Own glucometer	1.06 (0.86-1.30)	0.445	-	-	1.12 (0.87-1.43)	0.480	-	-
Previous hba1c level	1.10 (0.86-1.41)	0.455	-	-	1.01 (0.75-1.35)	0.920	-	-
study hba1c level	0.88 (0.74-1.04)	0.142	-	-	0.94 (0.77-1.15)	0.432	-	-
Macrovascular complications	0.95 (0.78-1.15)	0.531	-	-	0.96 (0.76-1.21)	0.746	-	-
Microvascular complications	0.87 (0.75-1.02)	0.066	-	-	0.86 (0.72-1.03)	0.112	0.89 (0.81-1.03)	0.010
No. of comorbidities	1.02 (0.91-1.14)	0.683	-	-	1.01 (0.88-1.16)	0.865	-	-

Table 4. Bivariate and multivariable linear regression analysis of determinants of social and environment HRQoL among the study participants

Variable	WHOQOL-BREF Domains							
	Social				Environment			
	Crude β (95% C.I)	P-value	Adj. β (95% C.I)	P-value	Crude β (95% C.I)	P-value	Adj. β (95% C.I)	P-value
Study site (KNH)	1.27 (0.71-2.25)	0.409	1.56 (1.39-1.75)	<0.001	1.46 (1.11-1.92)	0.007	1.45 (1.34-1.57)	<0.001
Gender (male)	1.52 (1.06-2.18)	0.023	1.12 (1.01-1.24)	0.037	0.95 (0.81-1.10)	0.480	1.08 (1.01-1.15)	0.033

Variable	WHOQOL-BREF Domains							
	Social				Environment			
	Crude β (95% C.I)	P-value	Adj. β (95% C.I)	P-value	Crude β (95% C.I)	P-value	Adj. β (95% C.I)	P-value
Older Age	0.92 (0.83-1.01)	0.091	-	-	0.95 (0.91-0.99)	0.022	0.96 (0.93-1.01)	0.004
Marital status	1.01 (0.80-1.27)	0.944	-	-	0.98 (0.88-1.09)	0.696	-	-
Highest education level	0.95 (0.83-1.08)	0.416	-	-	1.06 (1.00-1.13)	0.042	-	-
Employment	1.13 (0.88-1.45)	0.317	-	-	1.04 (0.93-1.17)	0.490		
Residence (urban)	1.24 (0.95-1.63)	0.116	-	-	1.06 (0.98-1.15)	0.126	1.05 (1.01-1.10)	0.026
Physical activity	0.80 (0.52-1.22)	0.289	-	-	1.01 (0.83-1.23)	0.918	-	-
Cigarette smoking	0.88 (0.62-1.24)	0.465	-	-	1.15 (0.99-1.34)	0.071	-	-
Alcohol intake	0.81 (0.63-1.04)	0.099	-	-	0.96 (0.86-1.08)	0.506	0.93 (0.86-1.00)	0.048
BMI	1.02 (0.85-1.22)	0.861	-	-	1.05 (0.96-1.14)	0.269	-	-
Duration with diabetes	1.09 (0.88-1.35)	0.443	-	-	1.02 (0.92-1.13)	0.652	-	-
Own glucometer	1.29 (0.97-1.73)	0.080	-	-	1.05 (0.92-1.21)	0.446	-	-
Previous h HbA1c level	0.91 (0.65-1.28)	0.570	-	-	0.99 (0.85-1.17)	0.941	-	-
study hba1c level	1.05 (0.83-1.33)	0.673	-	-	0.99 (0.88-1.10)	0.789	-	-
Macrovascular complications	1.00 (0.76-1.32)	0.997	-	-	0.96 (0.84-1.09)	0.515	-	-
Microvascular complications	0.92 (0.74-1.13)	0.403	-	-	0.97 (0.88-1.07)	0.567	-	-
No. of comorbidities	0.95 (0.81-1.12)	0.558	-	-	1.00 (0.93-1.08)	0.983	-	-

4. DISCUSSION

There were more female participants at KNH compared to the herbal clinic. This may be reflective of broader trends in conventional healthcare utilization where women are more likely to seek medical care than men (Sikka et al., 2021). Patients on conventional therapies for type 2 diabetes were older, had longer disease duration and more comorbidities than those at the herbal clinic. Older patients with prolonged disease durations often require comprehensive care to address both the primary condition and associated comorbidities (Sahoo et al., 2021). Awareness of these sociodemographic and clinical differences in patients on conventional and herbal therapies can inform targeted interventions to enhance treatment outcomes for these populations. Glycemic monitoring, assessed by glucometer ownership and HbA1c testing, was inadequate at both study sites. Poor glycemic monitoring is linked to suboptimal glycemic control and an increased risk of diabetes-related complications (Imai et al., 2021). This finding highlights a critical gap in diabetes management at both settings. Prior research in Kenya has noted a lack of awareness and infrequent HbA1c testing among diabetic patients (Matheka et al., 2013). Therefore, initiatives are needed to improve access as well as patient and provider awareness of the importance of HbA1c monitoring for effective diabetes management.

This study compared health-related quality of life among patients treated for type 2 diabetes with conventional glucose-lowering agents with those receiving herbal antidiabetic medicines. Patients on conventional treatment had significantly higher HRQoL scores in all the domains compared to those recruited at the herbal clinic. This finding is similar to that reported in Japanese studies in which patients with type 2 diabetes on complementary and alternative medicine (CAM) were found to have lower HRQoL compared to those who did not use these forms of therapy (Lu et al., 2017; Mori et al., 2023). This trend has also been reported among CAM users with bronchial asthma (Huo et al., 2015) and inflammatory bowel disease (Opheim et al., 2016). Patients using complementary and alternative therapies including herbal drugs are likely to have disease complications and other comorbid conditions which may further compromise their health-related quality of life (Bayoumy et al., 2021a; Ruiz-Noa et al., 2021).

In this study, higher levels of education had significant positive effects on physical health scores. A study in Vietnam revealed that level of education has significant effects on HRQoL with higher scores among the educated and poorer scores among the illiterates (Kien et al., 2021). Individuals with diabetes who attain higher levels of education may benefit from improved social support, enhanced self-esteem, and have a better understanding of their condition (Kien et al., 2021). These factors may collectively contribute to better treatment adherence and improved health outcomes, including quality of life. Regular physical activity was also associated with improved scores in the physical HRQoL domain. Similar findings were reported in an Iranian study in which physical activity among patients with type 2 DM was associated with better overall QOL with the greatest improvements observed in the physical domain (Sadeghi et al., 2024). Physical activity on prescription (PAP) was also reported to improve physical functioning among Swedish patients (Brorsson Lundqvist et al., 2024). Physical activity plays a critical role in the management of type 2 diabetes. Regular exercise is helpful in controlling weight, blood sugar levels, blood pressure as well as in reducing the incidence of cardiovascular diseases. Moderate exercise can improve the body's immunity and insulin resistance resulting in better glycemic control, reduced risk of diabetes-related complications, and improved QOL (Shah et al., 2021).

Contrary to prior findings, participants with microvascular complications in this study showed moderate improvements in psychological domain scores. In Taiwan, moderately low HRQoL scores on mental health perspectives were reported among patients with diabetic complications (Pham et al., 2020). Development of neuropathy is associated with reduction in the physical and mental aspects of life (Arnold et al., 2022). The presence of microvascular complications also increases the risk of depression (Le et al., 2022). Health-related quality of life in patients with type 2 diabetes is affected by factors such as diabetes-related complications, clinical conditions and sociodemographic characteristics (Tan et al., 2023). This finding therefore warrants further investigation to identify potential contributing variables. Male participants in this study were more likely to experience better social HRQoL compared to their female counterparts. Generally, women play the role of care providers in their families and therefore may not receive the

necessary support from other family members in managing and coping with diabetes (Moeineslam et al., 2019). Similarly, male participants had better scores on the environment domain. This may reflect better means of transportation, security and access to health information among the male participants compared to the female participants.

Older age was associated with better scores in the environmental domain of HRQoL among the study participants. Advancing age is often linked to a decline in HRQoL due to the increased risk of onset and progression of diabetes-related complications and comorbidities (Nguyen et al., 2018). However, some studies suggest that older adults may report higher satisfaction in certain HRQoL domains, potentially due to adaptive coping mechanisms and fewer responsibilities such as those related to work and family (Ibrahim et al., 2016). Alcohol intake was associated with improved scores in the environmental domain. Moderate alcohol intake may confer cardiovascular benefits, potentially enhancing HRQoL (Song et al., 2023). On the other hand, alcohol consumption increases the risk of comorbidities and may have negative economic consequences leading to poor HRQoL (Wonde et al., 2022). Urban residence was associated with better scores in the environmental domain. This is supported by similar findings among type 2 diabetes patients in Ethiopia (Aschalew et al., 2020). Although there are limited studies comparing diabetes HRQoL in rural versus urban residents, findings from studies in healthy populations have reported better HRQoL scores from urban dwellers compared to rural residents (Zhang et al., 2022). Urban residents are likely to have better access to transport, health services and health information leading to better HRQoL compared to rural residents (Pope et al., 2022).

5. CONCLUSION

Treatment with conventional glucose-lowering therapies at Kenyatta National Hospital was associated with significantly better scores in all the HRQoL domains. Higher education level and engagement in physical activity were additional determinants of physical HRQoL. Microvascular complications were associated with higher psychological domain scores. Urban residence, alcohol consumption, and older age were linked to better scores in the environment domain. Male gender was a significant determinant of both social and environment HRQoL.

6. STUDY LIMITATIONS

This study had several limitations. Evaluating HRQoL required patients to recall their past feelings, introducing potential recall bias. This was mitigated by limiting the recall period to two weeks. Additionally, the number of participants using herbal glucose-lowering agents was smaller than those on conventional drugs. This non-equivalence of groups was addressed through multivariable linear regression analysis.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

CONSENT

All authors declare that written informed consent was obtained from the participants. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.

ETHICAL APPROVAL

The KNH/UON Ethics and Research Committee granted ethical approval for this research (Approval number KNH/ERC/R/91).

ACKNOWLEDGEMENT

We wish to convey our heartfelt gratitude to the management, staff and study participants at Kenyatta National Hospital and New Life Herbal Clinics for their support and cooperation during this study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Arnold, S. V., Khunti, K., Tang, F., Chen, H., Nicolucci, A., Gomes, M. B., Ji, L., Shestakova, M. V., Watada, H., Cooper, A., Fenici, P., Hammar, N., Medina, J., & Kosiborod, M. (2022). Impact of micro- and macrovascular complications of type 2 diabetes on quality of life: Insights from the

DISCOVER prospective cohort study. *Endocrinology, Diabetes & Metabolism*, *5*(2), 14. https://doi.org/10.1002/EDM2.321

Aschalew, A. Y., Yitayal, M., & Minyihun, A. (2020). Health-related quality of life and associated factors among patients with diabetes mellitus at the University of Gondar referral hospital. *Health and Quality of Life Outcomes*, *18*(1), 1–8. https://doi.org/10.1186/S12955-020-01311-5/TABLES/5

Association, A. D. (2022). Professional Practice Committee: Standards of Medical Care in Diabetes—2022. *Diabetes Care*, *45*(Supplement_1), S3–S3. https://doi.org/10.2337/DC22-SPPC

Bayoumy, I. El, Dawod, W., Bayoumy, I. El, & Dawod, W. (2021). Herbal Use and Perceptions among Patients with Type 2 Diabetes Mellitus in Kuwait. *Journal of Diabetes Mellitus*, *12*(1), 50–62. https://doi.org/10.4236/JDM.2022.121006

Brorsson Lundqvist, E., Praetorius Björk, M., & Bernhardsson, S. (2024). Physical activity on prescription in Swedish primary care: a survey on use, views, and implementation determinants amongst general practitioners. *Scandinavian Journal of Primary Health Care*, *42*(1), 61–71. https://doi.org/10.1080/02813432.2023.2288126

Chang, Y. W., Shen, F. C., & Chen, C. Y. (2023). Investigation of treatment satisfaction and health-related quality of life after add-on to metformin-based therapy in patients with type 2 diabetes. *Frontiers in Public Health*, *11*, 1152284. https://doi.org/10.3389/FPUBH.2023.1152284/BIBTEX

Chaturvedi, R., Desai, C., Patel, P., Shah, A., & Dikshit, R. K. (2018). An evaluation of the impact of antidiabetic medication on treatment satisfaction and quality of life in patients of diabetes mellitus. *Perspectives in Clinical Research*, *9*(1), 15. https://doi.org/10.4103/PICR.PICR_140_16

Chege, I. N., Okalebo, F. A., Guantai, A. N., & Karanja, S. (2020). Effectiveness and Safety of Kenyan Anti- Diabetic Herbal Formulations: A Pilot Study. *International Journal of Health Sciences and Research*, *10*(2), 109–124. https://www.ijhsr.org/IJHSR_Vol.10_Issue.2_Feb2020/IJHSR_Abstract.018.html

Constitution of the World Health Organization. (2011). *American Journal of Public Health*, *36*(11), 1315–1323. https://doi.org/10.2105/AJPH.36.11.1315

Davies, M. J., D'Alessio, D. A., Fradkin, J., Kernan, W. N., Mathieu, C., Mingrone, G., Rossing, P., Tsapas, A., Wexler, D. J., & Buse, J. B. (2018). Management of Hyperglycemia in Type 2 Diabetes, 2018. A Consensus Report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetes Care*, *41*(12), 2669. https://doi.org/10.2337/DCI18-0033

E.K, Genga., C.F, Otieno., E.N, Ogola., & M.C, Maritim. (2014). Assessment of the Perceived Quality of Life of Non insulin Dependent Diabetic patients attending the Diabetes Clinic in Kenyatta National Hospital. *IOSR Journal of Pharmacy (IOSRPHR)*, *04*(03), 15–21. https://doi.org/10.9790/3013-040315-21

Elsa, O., Kuria, K., Nyamu, D., & Mwangangi, E. (2017). Utilization of Herbal Medicines among Diabetic Patients Attending Kenyatta National Hospital Outpatient Clinic. *Journal of Complementary and Alternative Medical Research*, *3*(1), 1--18. https://doi.org/10.9734/jocamr/2017/33962

Elsayed, N. A., Aleppo, G., Aroda, V. R., Bannuru, R. R., Brown, F. M., Bruemmer, D., Collins, B. S., Hilliard, M. E., Isaacs, D., Johnson, E. L., Kahan, S., Khunti, K., Leon, J., Lyons, S. K., Perry, M. Lou, Prahalad, P., Pratley, R. E., Seley, J. J., Stanton, R. C., & Gabbay, R. A. (2023). 6. Glycemic Targets: Standards of Care in Diabetes—2023. *Diabetes Care*, *46*(Supplement_1), S97–S110. https://doi.org/10.2337/DC23-S006

Gruneir, A., Markle-Reid, M., Fisher, K., Reimer, H., Ma, X., & Ploeg, J. (2016). Comorbidity Burden and Health Services Use in Community-Living Older Adults with Diabetes Mellitus: A Retrospective Cohort Study. *Canadian Journal of Diabetes*, *40*(1), 35–42. https://doi.org/10.1016/J.JCJD.2015.09.002

Harper, A., Power, M., Orley, J., Herrman, H., Schofield, H., Murphy, B., Metelko, Z., Szabo, S., Pibernik-Okanovic, M., Quemada, N., Caria, A., Rajkumar, S., Kumar, S., Saxena, S., Chandiramani, K., Amir, M., Bar-On, D., Tazaki, M., Noji, A., … Sartorius, N. (1998). Development of the World Health Organization WHOQOL-BREF quality of life assessment. The WHOQOL Group. *Psychological Medicine*,

28(3), 551–558. https://doi.org/10.1017/S00332917980066 67

Huo, N., Ray, G. E., Mehta, S., & Lobello, S. G. (2015). Complementary and alternative medicine use among people with asthma and health-related quality of life. *The Journal of Asthma : Official Journal of the Association for the Care of Asthma*, *52*(3), 308–313. https://doi.org/10.3109/02770903.2014.963 867

Ibrahim Abdel-Latif Megahed, F., Ibrahim Abd El Latif, F., Ali Abd El Wahid, H., Ahmed Mohamed, A., & Kassem Farg, H. (2016). *Physical and psychological health domains of quality of life in type 2 diabetic patients in relation to clinical factors of diabetes mellitus in Egypt*. https://www.netjournals.org/z_IRJMMS_16 _015.html

IDF Diabetes Atlas 2021 | IDF Diabetes Atlas. (n.d.). Retrieved January 15, 2025, from https://diabetesatlas.org/atlas/tenth-edition/

Imai, C., Li, L., Hardie, R. A., & Georgiou, A. (2021). Adherence to guideline-recommended HbA1c testing frequency and better outcomes in patients with type 2 diabetes: A 5-year retrospective cohort study in Australian general practice. *BMJ Quality and Safety*, *30*(9), 706–714. https://doi.org/10.1136/BMJQS-2020-012026

Jing, X., Chen, J., Dong, Y., Han, D., Zhao, H., Wang, X., Gao, F., Li, C., Cui, Z., Liu, Y., & Ma, J. (2018). Related factors of quality of life of type 2 diabetes patients: A systematic review and meta-analysis. *Health and Quality of Life Outcomes*, *16*(1). https://doi.org/10.1186/S12955-018-1021-9

Karara, M. W., Okalebo, F. A., Ndirangu, P. K., & Opanga, S. A. (2022). Comparative Glycemic Control in Adult Patients with Type 2 Diabetes on Herbal and Conventional Glucose-Lowering Agents in Nairobi County, Kenya. *Journal of Complementary and Alternative Medical Research*, 25–34. https://doi.org/10.9734/JOCAMR/2022/V19 I2385

Le, T. D., Duong, H. H., Nguyen, L. T., Nguyen, N. P. T., Nguyen, S. T., & Van Ngo, M. (2022). The Relationship Between Depression and Multifactorial Control and Microvascular Complications in Vietnamese with Type 2 Diabetes Mellitus Aged 30–60 Years. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, *15*, 1185–1195. https://doi.org/10.2147/DMSO.S354443

Lu, Y., Wang, N., Chen, Y., Nie, X., Li, Q., Han, B., Chen, Y., Xia, F., Cang, Z., Lu, M., Meng, Y., & Lu, Y. (2017). Health-related quality of life in type-2 diabetes patients: A cross-sectional study in East China. *BMC Endocrine Disorders*, *17*(1), 1–7. https://doi.org/10.1186/S12902-017-0187-1/TABLES/5

Matheka, D. M., Kilonzo, J. M., Munguti, C. M., & Mwangi, P. W. (2013). Pattern, knowledge and practices of HbA1C testing among diabetic patients in a Kenyan tertiary referral hospital. *Globalization and Health*, *9*(1), 1–4. https://doi.org/10.1186/1744-8603-9-55/METRICS

Moeineslam, M., Amiri, P., Karimi, M., Jalali-Farahani, S., Shiva, N., & Azizi, F. (2019). Diabetes in women and health-related quality of life in the whole family: a structural equation modeling. *Health and Quality of Life Outcomes*, *17*(1). https://doi.org/10.1186/S12955-019-1252-4

Mori, Y., Daikuhara, H., Oshima, T., Suzuki, H., Okada, S., & Miyatake, N. (2023). Use of Complementary and Alternative Medicine and Its Relationship with Health-Related Quality of Life (HRQOL) in Patients with Type 2 Diabetes Mellitus. *Epidemiologia 2023, Vol. 4, Pages 53-59*, *4*(1), 53–59. https://doi.org/10.3390/EPIDEMIOLOGIA4 010005

Nguyen, H. T. T., Moir, M. P. I., Nguyen, T. X., Vu, A. P., Luong, L. H., Nguyen, T. N., Nguyen, L. H., Tran, B. X., Tran, T. T., Latkin, C. A., Zhang, M. W. B., Ho, R. C. M., & Vu, H. T. T. (2018). Health-related quality of life in elderly diabetic outpatients in Vietnam. *Patient Preference and Adherence*, *12*, 1347. https://doi.org/10.2147/PPA.S162892

Opheim, R., Lie Høivik, M., Bernklev, T., Jelsness-Jørgensen, L. P., & Moum, B. (2016). The Use of Complementary and Alternative Medicine among Patients with Inflammatory Bowel Disease Is Associated with Reduced Health-Related Quality of Life. *Gastroenterology Research and Practice*, *2016*. https://doi.org/10.1155/2016/6453657

Oyewole, O. O., Ale, A. O., Ogunlana, M. O., & Gurayah, T. (2023). Burden of disability in type 2 diabetes mellitus and the moderating effects of physical activity.

World Journal of Clinical Cases, *11*(14), 3128. https://doi.org/10.12998/WJCC.V11.I14.3128

Pham, T. B., Nguyen, T. T., Truong, H. T., Trinh, C. H., Du, H. N. T., Ngo, T. T., & Nguyen, L. H. (2020). Effects of Diabetic Complications on Health-Related Quality of Life Impairment in Vietnamese Patients with Type 2 Diabetes. *Journal of Diabetes Research*, *2020*. https://doi.org/10.1155/2020/4360804

Pope, C. N., Stavrinos, D., Fazeli, P. L., & Vance, D. E. (2022). Transportation Barriers and Health-Related Quality of Life in a Sample of Middle-Aged and Older Adults Living with HIV in the Deep South. *AIDS and Behavior*, *26*(7), 2148–2158. https://doi.org/10.1007/s10461-021-03560-x

Ruiz-Noa, Y., Ibarra-Reynoso, L. D. R., Ruiz-Padilla, A. J., Alonso-Castro, A. J., Ramírez-Morales, M. A., Zapata-Morales, J. R., Orozco-Castellanos, L. M., Solorio-Alvardo, C. R., & Lara-Morales, A. (2021). Use of herbal medicine for diabetes mellitus in adults from the central-western region of Mexico. *Primary Care Diabetes*, *15*(6), 1095–1099. https://doi.org/10.1016/j.pcd.2021.08.010

Sadeghi, D., Motlagh, M. K., Darvish, A., Daryaafzoon, M., Mohamadnejad, E., Molaei, A., Montazerlotf, P., & Hosseini, R. S. S. (2024). Comparative effect of physical health training and psychological training of the theory of reasoned action (TRA) model on the life quality of patients with diabetes in Tehran, Iran: utilization of message texting. *BMC Endocrine Disorders*, *24*(1), 1–12. https://doi.org/10.1186/s12902-024-01598-1

Sahoo, H., Govil, D., James, K. S., & Prasad, R. D. (2021). Health issues, health care utilization and health care expenditure among elderly in India: Thematic review of literature. *Aging and Health Research*, *1*(2), 100012. https://doi.org/10.1016/J.AHR.2021.100012

Shah, S. Z. A., Karam, J. A., Zeb, A., Ullah, R., Shah, A., Haq, I. U., Ali, I., Darain, H., & Chen, H. (2021). Movement is Improvement: The Therapeutic Effects of Exercise and General Physical Activity on Glycemic Control in Patients with Type 2 Diabetes Mellitus: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Diabetes Therapy*, *12*(3), 707–732. https://doi.org/10.1007/s13300-021-01005-1

Sikka, N., DeLong, A., Kamano, J., Kimaiyo, S., Orango, V., Andesia, J., Fuster, V., Hogan, J., & Vedanthan, R. (2021). Sex differences in health status, healthcare utilization, and costs among individuals with elevated blood pressure: the LARK study from Western Kenya. *BMC Public Health*, *21*(1), 1–12. https://doi.org/10.1186/S12889-021-10995-3/TABLES/4

Song, R. J., Larson, M. G., Aparicio, H. J., Gaziano, J. M., Wilson, P., Cho, K., Vasan, R. S., Fox, M. P., & Djoussé, L. (2023). Moderate alcohol consumption on the risk of stroke in the Million Veteran Program. *BMC Public Health*, *23*(1), 1–12. https://doi.org/10.1186/S12889-023-17377-X/TABLES/7

Sun, H., Saeedi, P., Karuranga, S., Pinkepank, M., Ogurtsova, K., Duncan, B. B., Stein, C., Basit, A., Chan, J. C. N., Mbanya, J. C., Pavkov, M. E., Ramachandaran, A., Wild, S. H., James, S., Herman, W. H., Zhang, P., Bommer, C., Kuo, S., Boyko, E. J., & Magliano, D. J. (2022). IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. *Diabetes Research and Clinical Practice*, *183*. https://doi.org/10.1016/J.DIABRES.2021.109119

Tan, M. H. P., Ong, S. C., Bujang, M. A., Shah, S. A., & Mustafa, N. (2023). Evaluation of the health-related quality of life of patients with type 2 diabetes in relation to macrovascular and microvascular complications. *Acta Diabetologica*, *60*(12), 1735–1747. https://doi.org/10.1007/S00592-023-02164-2/METRICS

Tran Kien, N., Phuong Hoa, N., Minh Duc, D., & Wens, J. (2021). Health-related quality of life and associated factors among patients with type II diabetes mellitus: A study in the family medicine center (FMC) of Agricultural General Hospital in Hanoi, Vietnam. *Health Psychology Open*, *8*(1). https://doi.org/10.1177/2055102921996172

Wonde, T. E., Ayene, T. R., Moges, N. A., & Bazezew, Y. (2022). Health-related quality of life and associated factors among type 2 diabetic adult patients in Debre Markos Referral Hospital, Northwest Ethiopia.

Heliyon, *8*(8). https://doi.org/10.1016/J.HELIYON.2022.E10182

Yassin, A. T., Mlombe, Y., Beiersmann, C., Bruckner, T., Zeier, M., Neuhann, F., Shivalli, S., & Elyan Edwige Barbara, V. (2016). Are We Treating the Right People? Are We Treating the People Right? Health Status, Knowledge and Quality of Life amongst Patients with Diabetes at a Specialized Clinic at Kamuzu Central Hospital, Malawi. *International Journal of TROPICAL DISEASE & Health*, *16*(2), 1–14. https://doi.org/10.9734/IJTDH/2016/25601

Zhang, J., Xiao, S., Shi, L., Xue, Y., Zheng, X., Dong, F., Xue, B., & Zhang, C. (2022). Differences in Health-Related Quality of Life and Its Associated Factors Among Older Adults in Urban and Rural Areas. *Risk Management and Healthcare Policy*, *15*(July), 1447–1457. https://doi.org/10.2147/RMHP.S373077

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/129827