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HEALTH-RELATED QUALITY OF LIFE, WORK PRODUCTIVITY, AND ASSOCIATED FACTORS AMONG PATIENTS WITH TYPE 2 DIABETES MELLITUS ON ANTI-DIABETIC MEDICATIONS: A CROSS-SECTIONAL STUDY IN NORTH CENTRAL NIGERIA

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ABSTRACT

Diabetes mellitus poses a major public health challenge in Africa, particularly in Nigeria, due to its high morbidity, mortality, and economic impact, which are worsened by its chronic nature and related complications. The aim of this study was to assess the health-related quality of life (HRQoL), work productivity, and associated factors among patients with Type 2 Diabetes Mellitus (T2DM) receiving anti-diabetic medications at a secondary health facility in Ilorin, Kwara State, North Central Nigeria. A cross-sectional study through convenient sampling was conducted in patients registered in the last ten years (10) from (May 2013 to August 2023). Participants were drawn after a sample size of 304 participants was calculated. Informed consent was obtained from all participants, and ethical approval was granted by Ethics and Research Committee of the Institution (Approval ID: ERC /MOH/2023/04/102). Data on health-related quality of life were collected using the EQ-5D-5L and EQ-VAS instruments, while the Work Productivity and Activity Impairment (WPAI) questionnaire was used to assess changes in work productivity. Statistical analysis involved both descriptive and inferential methods, with results presented in tables. Of the 304 participants included, 108(35.5%) were female, 196(64.4%) were male. Majority fell within the age group of 55-65 years old (39.5%). Majority140 (46%) were in the lower middle income ($39-130) category. Biguanide plus sulphonyl urea combination therapy recorded the highest usage (71.1%). Overall loss of productivity and activity impairment as outcomes of work productivity was found to be 24.8% and 33.6%. The mean EQ-5D utility scores and EQ-VAS scores were 0.7033±0.1525 and 63.57±17.16 Factors such as older age, presence of complications and comorbidities, and higher overall productivity loss are significantly associated with lower HRQoL scores. Conversely, being employed and having a good monthly income are significantly associated with better. Health-related quality of life of individuals with type 2 diabetes, as measured by EQ-5D utility and EQ-VAS scores. Results highlight the importance of socioeconomic and clinical factors in influencing the quality of life of patients with type 2 diabetes.

Keywords: EQ-VAS, EQ-5D-5L, HRQoL, Nigeria, Quality of life, T2DM, WPAI

INTRODUCTION

Diabetes is a chronic, metabolic disease characterised by elevated levels of blood glucose (or blood sugar), which on the long run results into serious damage of the heart, blood vessels (WHO, 2023). In 2019 WHO estimated that 415 million people were living with diabetes globally, this is estimated to be 1 in 11 of the world's adult population. 46% of people living with the disease are undiagnosed and this figure is

expected to reach 640 million by 2040. It was reported that the prevalence of diabetes also varied by sex (adult) with 13.7% of men and 11.7% of women in US. In Nigeria it was reported that there is higher prevalence of type 2 diabetes in females compared to males which is attributed to both biological and psychosocial predictors (Tella *et al.*,2021). The World Health Organization (WHO) defines quality of life (QoL) as an individual's subjective evaluation of their life circumstances, encompassing their cultural context, values, goals, expectations, and concerns (Orley,1995),while health-related quality of life is defined as the valuation of life duration, adjusted for the impact of impairments, functional limitations, personal perceptions, and social opportunities, all of which are influenced by disease, injury, treatment, or policy (Patrick and Erickson 1993). The main aspect in a HRQoL study is how the manifestation of an illness or treatment is experienced by an individual (Patrick and Erickson 1993). The EQ-5D (EuroQol 5-Dimensions) questionnaire is widely used to score patient preferences and generate index values. However, work productivity is a measure of how efficiently and effectively a worker or group of workers produce goods and services. (Hubens,*et al.,* 2021).

Studies have shown that there is a paucity of comprehensive evidence on health-related quality of life (HRQoL), work productivity, and their determinants among patients with type 2 diabetes mellitus (T2DM), particularly in the Nigerian context. (Ababio *et al.,* 2017). There are several studies highlighting assessments in health-related quality of life in the Ethiopian context. For instance, Aschalew *et al.,* (2020) found that higher HRQoL was associated with exercising, adherence to a recommended diet, foot care, moderate alcohol consumption, and the absence of comorbidities. Conversely, older age, unemployment, and being single or widowed were significantly associated with lower HRQoL. Similarly, Gebremedhin *et al.,* (2019) reported that age, disease duration, and fasting blood glucose levels were inversely associated with all domains of HRQoL ($p < 0.001$), while body mass index (BMI) also showed an inverse relationship. A study conducted in Addis Ababa by Degu and Wondimagegnehu (2019) further indicated that diabetic nephropathic pain negatively impacted HRQoL. Likewise, a more recent study from Iran revealed that individuals living with diabetes experienced reduced work efficiency and increased absenteeism, resulting in substantial declines in overall work productivity (Ebrahimipour *et al.,* 2021). Type 2 Diabetes Mellitus (T2DM) is a growing public health concern in Northern Nigeria, where limited access to healthcare, poor disease awareness, and socio-economic challenges compound its impact. Studying Health-Related Quality of Life (HRQoL) and productivity loss among individuals living with T2DM is essential to understanding the full burden of the disease in this region. HRQoL assessments reveal how diabetes affects patients' physical functioning, psychological well-being, social relationships, and ability to perform daily activities. This is especially important in Northern Nigeria, where cultural and economic factors often influence health-seeking behavior and treatment adherence (Gureje, *et al*., 2023).

By highlighting the multidimensional impact of T2DM, HRQoL and productivity studies provide evidence to inform more effective, patient-centered care models, guide resource allocation, and shape public health interventions tailored to the unique needs of Northern Nigeria's population (Kass *et al.,* 2023). This study aims to present a

comprehensive analysis of the HRQoL,work productivity, and potential factors in patients with type 2 diabetes mellitus that are on anti-diabetic therapy.

METHODOLOGY

Study Setting

This study was conducted in Ilorin, the capital of Kwara State in the North-Central geopolitical zone of Nigeria. As of the 2012 census, the population of Ilorin was officially recorded at 1,084,681, with a notable annual growth rate of 3.22%. The city spans an area of 765 square kilometers and is geographically situated at coordinates 8º30′N latitude and 4º32′E longitude. The General Hospital Ilorin boasts a multidisciplinary team of specialists and 600 bed spaces, providing comprehensive care to patients from Kwara and neighboring states, including Oyo, Osun, and Kogi. Previously serving as a temporary site for the University of Ilorin Teaching Hospital, this well-equipped secondary health facility is strategically located in the Ilorin West
Local Government Area, with geographical coordinates 8º32′14.298′′N and 4º38′50.327′′E." The prevalence of type 2 Diabetes mellitus in general hospital is 5.2%. (Adeloye *et al*., 2017)

Study design

The study employed a cross-sectional design, with participants recruited through convenient sampling.

Study Population

The study population comprised of patients aged 18-70 years diagnosed with Type-2 Diabetes Mellitus and registered at the General out-patient clinic and Endocrine clinic of General Hospital, Ilorin in the last ten 10 years (May 2013 to August 2023) and still attending the facility for checkup. All type 2 diabetes patients aged over 18 years, who presented for treatment at General Hospital Ilorin and had been diagnosed for more than six months, and provided informed consent were included in the study. Inpatients and individuals with any long-term or temporary psychiatric conditions were excluded.

Sample size

Sample size was determined by a formula prescribed by (Araoye,2003), and 304 participants were included in the study.

Data collection

Data collection tools

Data collection was facilitated through the use of self-completed questionnaires, specifically the EQ-5D-5L (Sprangers,2022) and the Work Productivity and Activity Impairment Questionnaire: General Health version (WPAI:GH) ((Ebrahimipour *et al.,* 2021). The instruments measure Health related quality of life and work productivity respectively.

Work Productivity and Activity Impairment Questionnaire: General Health version (WPAI:GH) was used to estimate change in work productivity. Concerning validity, similar questionnaire which is the WHO Student Drug Use Survey Model Questionnaire has been validated and used in Abeokuta, a Nigerian setting (Adelakun *et al.,*1989). WPAI:GH is a self-completed questionnaire that has 6 questions. This is an instrument for measuring health-related productivity changes. It has a recall of 7 days and also visual analogue scale (VAS) ranges from 1-10. The VAS was used to measure the degree of patients' health on that specific day the data was collected.

Question 1: Currently employed/self employed

Question 2: Hours missed due to health problem.

Question 3: Hours missed due to other reasons.

Question 4: Hours actually worked.

Question 5: Degree health affected productivity while working using a scale 1-10 (VAS Scale).
Question 6: Degree health affected regular activities (unpaid).
These were used to calculate four outcomes for work productivity:

a. Work time missed/Absenteeism (%) = Q2/(Q2+Q4)
b. Impairment of work (%)/presenteeism = Q5/10
c. Activity impairment (%)/unpaid work = Q6/10
d. Overall work impairment = Q2/Q2+Q4) + [(1-(Q2/Q2+Q4))) (Q5/10)]

EQ-5D-5L: It consists of 2 parts; first part is EQ-5D-5L descriptive system that measures health-related quality of life across 5 domains (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression). Each dimension has 5 levels: no problem, slight problem, moderate problem, severe problem and extreme problem.The EQ-5D-5L requires respondents to simply mark X on the scale to indicate how their health was on that day and then to write the number marked on the scale in the box provided.Final result can a be 1-digit or a 5-digit number, or combination of the two. The 5-digit number shows a description of the patient's health state.

The second part is EQ visual analogue scale (EQ-VAS) in which respondents was asked to rate their health on a 20cm vertical visual analogue scale from 0-100 with end points labelled "best health you can imagine" and "worst health you can imagine".

Data collection procedure

Data collection took place on Mondays and Wednesdays, which were the designated clinical days for Endocrinology clinic. Patient data collection s facilitated through collaboration with the Consultant Endocrinologist. A designated space within the consultation room was provided for interviews, and the Endocrinologist would direct patients who gave informed consent to this area after their consultations. The questionnaires were self-administered and written in English. For participants who were not literate, trained interviewers administered the questionnaires by translating them into the respondents' native language.

Data Analysis and Ethical approval

Data were analysed using SPSS version 22.0. Descriptive statistics (means, frequencies, percentages, and standard deviations) were used to summarize socio-demographic, clinical, EQ-5D-5L, EQ-VAS, and WPAI data. **Pearson correlation** assessed associations between socio-demographic/clinical variables and HRQoL scores, while **Spearman correlation** was used to examine relationships between EQ-5D-5L, EQ-VAS, and work productivity outcomes. Also included were chi-square tests, which are used to compare observed data with expected data—specifically to determine whether any differences are due to chance or reflect a significant relationship between the variables studied or a difference between groups (McHugh,*etal.,*2013). Ethical approval was sought and obtained from the Ethics and Research Committee of the Institution (Approval ID: ERC /MOH/2023/04/102).

RESULTS

Socio demographic Profiles

Out of the 304 participants 35.5% (108) were male while 64.5 % (196) were female ($p = 0.315$, $X^2=64.718$) The participants' age ranged from 18-70 years. No participant has age below 35 years. ($p=0.353$, $X^2=.186.552$).

The participants' time diagnosed was grouped into two; 6 months to< 5 years and 5-10 years. Fifty-seven-point nine percent

the participants were diagnosed within 6 months to less than 5 years while 42.1% were diagnosed within 5-10 years (p=0.294, X^2=65.41). The monthly income of the participants was rated as low (below ₦30,000/39$), lower middle (₦ 30,000-/39$-100,000/130$), lower upper (₦100,000/130$-200.000/260$) and High (above ₦200,000/$260), considering Nigeria's minimum wage. Forty six percent had lower middle income, 21.7% had lower upper income, and 22.4% had low income and 9% had high income p= (0.444, X^2=121.531). As shown on table I

Table I: Socio-demographic characteristics of patients with T2DM attending General Hospital Ilorin (n=304).

Characteristic	Category	Frequency (N)	Percentage (%)	p-value	X^2
Sex	Male	108	35.5	0.315	64.718
	Female	196	64.5		
Age	18-24	-	-	0.353	186.552
	25- 34	-	-		
	35-44	22	7.2		
	45-54	54	17.8		
	55-65	120	39.5		
	65-70	108	35.5		
Marital status	Single	6	2.0	0.301	127.547
	Married	220	72.4		
	Divorce/separated	-	-		
	Widow/widower	78	25.7		
Education status	Informal	114	37.5	0.330	187.805
	Primary	48	15.8		
	Secondary	34	11.2		
	Tertiary	108	35.5		
Employment status	Employed	74	24.3	0.733	109.983
	Self-employed	174	57.2		
	Unemployed	56	18.4		
Time diagnosed	6 month- 5 years	176	57.9	0.294	65.413
	5-10 years	128	42.1		
Monthly income	Low	68	22.4	0.444	121.531
	Lower middle	140	46		
	Lower upper	66	21.7		
	High	30	9.9		

Clinical characteristics

Diabetes complications reported by the participants varied from leg ulcers, neuropathy, nephropathy, and retinopathy. 57.9%of the participants had no complications. Neuropathy was the major complication (32.9%), while the least common complication was observed in 1.3% (p=0.033, X^2=281.68) of the participants who had both neuropathy and retinopathy.

The comorbidity of participants varied from Arthritis, benign prostate hypertrophy

(BPH), chronic kidney disease (CKD), human immunodeficiency virus (HIV), hypertension and related diseases (HTN), hepatitis B (HBsAg), hyperlipidaemia and hyperthyroidism. 31.6% of the participants had no comorbidity, hypertension was the major comorbidity, (44.1%) while the least common comorbidity was observed in 0.7% of the participants who had hyperlipidaemia, hypertension and arthritis. (p=<0.001, X^2 =1022.129)

In the study, most of the participants were on a combination of different classes of anti-diabetic medications. Few participants were on monotherapy. Biguanide plus sulphonyl urea combination recorded the highest usage (71.1%), while the least usage (0.7%) was observed for some other combinations (p=<0.001, X^2=830.917)

Non-pharmacological treatments were exercise 4.6%, dietary 38.8%, and dietary exercise 38.2% while 18.4 % were not following non-pharmacological treatments. These are presented in table II below. (p=0.142, X2 =200.142)

Table II: Clinical characteristics of patients with T2DM attending General Hospital Ilorin (n=304)

Characteristic	Category	Frequency (N)	Percentage (%)	p-value	X^2
Complications	Leg Ulcer	2	0.7	0.033	281.68
	Neuropathy	100	32.9		
	Nephropathy	20	6.57		
	None	176	57.9		
	Retinopathy	2	0.7		
	Retinopathy, Neuropathy	4	1.3		
Comorbidity	Arthritis	8	2.6	0.000**	1022.129
	BPH, HTN, HBsAg	4	1.3		
	CKD	4	1.3		
	HIV	4	1.3		
	HTN	134	44.1		
	HTN, HbsAg	2	0.7		
	HTN, HYPERLIPIDEMIA	6	2.0		
	HTN, ARTHRITIS	16	5.3		
	HTN, CKD	14	4.6		
	HTN, HYPERTHYROIDISM	2	0.7		
	HYPERLIPIDEMIA	10	3.3		
	HYPERLIPIDEMIA HTN, ARTHRITIS	2	0.7		
	NONE	96	31.6		
	ULCER	2	0.7		
Current medication	Biguanide	26	8.6	0.000**	830.917
	Biguanide, sulphonyl	216	71.1		

	urea				
	Biguanide, sulphonyl urea, DPP-4, Insulin	2	0.7		
	Biguanide, sulphonyl urea, DPP-4	14	4.6		
	Biguanide, DPP-4	4	1.3		
	Biguanide, Insulin	6	2.0		
	Biguanide, SGLT2	2	0.7		
	Biguanide, sulphonyl urea, Insulin	18	5.9		
	Biguanide, sulphonyl urea, SGLT2	2	0.7		
	DPP-4, Biguanide, Insulin	4	1.3		
	Sulfonylurea, Insulin	6	2.0		
	Sulphonyl urea	4	1.3		
Non-Pharmacological therapy	Dietary				
	Exercise	118	38.8	0.142	200.142
	Exercise, dietary	14	4.6		
	None	116	38.2		

[a] Definition of all abbreviations BPH-Benign Prostatic Hyperplasia, HTN-Hypertension, CKD-Chronic Kidney Disease, HIV- Human Immune -deficiency Virus, DPP-4 -Dipeptidyl Peptidase 4 Inhibitors, SGLT2 I- Sodium-Glucose Co-Transporter 2Inhibitors, HbsAg- Hepatitis B surface antigen.

Overall EQ-5D Index scores and EQ-VAS scores of patients

The overall mean EQ-5D utility scores and overall mean EQ-VAS scores were 0.7033±0.1525 and 63.57±17.16 summarized on table III below.

TABLE III: Overall mean EQ-5D Index scores and mean EQ-VAS scores of patients with T2DM attending General Hospital Ilorin (n=304)

ITEM	MEAN	STANDARD DEVIATION
EQ-5D INDEX SCORE	0.7033	0.1525
EQ-VAS SCORE	63.5724	17.1606

Relationship between socio-demographic information/clinical characteristics and Health-related quality of Life.

Relationship between the socio-demographic data, clinical characteristics and utility scores were established using Pearson correlation test. Age, Employment status and Monthly income were significant at p value of 0.016, 0.035 and 0.025 respectively. Clinical characteristics such as complication, co morbidity and medication were as significant as presented on table V below.

Table IV: Relationship between Socio-demographic, Clinical characteristics, EQ-5D utility scores using Pearson correlation for patients with T2DM attending General Hospital Ilorin (n=304).

Socio-demographic, Clinical characteristics		R	Sig
Sex	Male	-0.056	0.497
	Female		
Age	18-24	-0.314*	0.016
	25-34		
	35-44		
	45-54		
	55-64		
	65-70		
MARITAL STATUS	Single	0.084	0.302
	Married		
	Widow/Widower		
	Divorce/Separated		
EDUCATION STATUS	Informal	-0.084	0.301
	Primary		
	Secondary		
	Tertiary		
EMPLOYMENT STATUS	Employed	0.171*	0.035
	Self-employed		
	Unemployed		
TIME DIAGNOSED	6 month- 5 years	-0.036	0.662
	5-10 years		
MONTHLY INCOME	Low	0.093*	0.025
	Lower middle		
	Upper middle		
	High		
COMORBIDITY	HTN	-0.981**	0.002
	HIV	-1.000**	0.000
	CKD	-1.000**	0.000
	ULCER	-1.000**	0.000
	Arthritis	-0.577	0.423
	HTN + CKD	-0.639	0.122
	HTN + Arthritis	-0.966**	0.002
	HTN + HYPERLIPIDEMIA	-0.837**	0.005
	BPH + HTN + HbsAg	-1.000**	0.000
COMPLICATION	NEUROPATHY	-0.871**	0.000
	NEHPROPATHY	-0.706*	0.023
	NEURO + NEPHROPATHY	-1.000**	0.000
MEDICATION	SULPHONYLUREA	-0.261	0.832
	BIGUANIDE	0.912**	0.000
	BIGUANIDE +SULPONYLUREA	0.811**	0.000
	BIGUANIDE +DPP-4	-0.993	0.073

BIGUANIDE +SULPONYLUREA + DPP-4	0.910**	0.002
BIGUANIDE +SULPONYLUREA + INSULIN	0.693	0.084
BIGUANIDE +DPP-4 + INSULIN	1.000**	0.000
SULPHONYLUREA + INSULIN	1.000**	0.000
BIGUANIDE + INSULIN	1.000**	0.000

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)

Means and standard deviation of the four outcomes of work productivity and activity impairment for patients with T2DM attending General Hospital Ilorin(n=304).

The four outcomes of WPAI were 7.9857±12.0931%, 15.9868±19.9868%, 21.0419±24.8157%, and 33.6184±24.4556% for work time missed, impairment of work, overall work productivity loss and activity impairment respectively as shown in table VI

Table VI: Mean and standard deviation for WPAI Outcome for patients with T2DM attending General Hospital Ilorin (n=304).

WPAI OUTCOME	MEANS	STANDARD DEVIATION
Work time missed	7.9857	12.0931
Impairment of work %	15.9868	19.9868
Overall work productivity loss %	24.8157	21.0419
Activity impairment %	33.6184	24.4556

Relationship between health-related quality of life and loss of productivity

The WPAI outcomes versus mean EQ-5D utility scores/EQ-VAS scores were used to establish the relationship between health-related quality of life and loss of productivity using Spearman correlation coefficient. Work time missed and activity impairment had positive and negative correlation with EQ-5D respectively. Work time missed, impairment of work and overall work had a positive correlation with EQ-VAS scores while activity impairment had a negative correlation with EQ-VAS. The results are presented in the table VII below:

Table VI: Association between health-related quality of life (Mean EQ-5D-5L and EQ-VAS scores) and productivity using spearman rank order correlation coefficient

	EQ-5D-5L SCORES		EQ-VAS SCORE	
	R	p-value	R	p-value
WORK TIME MISSED	0.227**	0.005	0.221**	0.006
IMPAIRMENT OF WORK	0.100	0.220	0.200*	0.014
OVERALL WORK	0.127	0.120	0.216**	0.008
ACTIVITY IMPAIRMENT	-0.706**	0.000	-0.661**	0.000

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

DISCUSSION

The results from present study showing that majority of participants were within the age of 55-65 years is similar to results from previously carried out studies, in Enugu (Nwatu *et.al.,* 2019), Port-Harcourt (Okpuruka *et.al,.* 2022), Oshogbo (Adijat,*et.al,* 2021) and Ikorodu, Nigreia (Adeunmi *et.al,* 2022). The prevalence of diabetes which was found to be highest in females and lowest in males could be due to the sedentary lifestyles of females which encourage them to be overweight and have higher BMI (Diabetes Mellitus Predisposing factors). This was similar to gender distribution reported by IDF 10th edition (IDF 2021) and study done in Port-Harcourt Nigeria (Okpuruka *et.al.,*2022) with females and males having a prevalence of 52% and 48% respectively.

Majority of the participants having informal education (highest frequency), were inconsistent with a study carried out by Abubakar, (2014),in the Southern part of Nigeria where the majority of the participants had tertiary education and small number of participants had informal education. Also inconsistent with study done in Enugu (Nwatu,*et.al.,*2019) where most of the participants also had informal education. This was because in Nigeria, the percentage of literates was found to be higher in the Southern part of the country than in the Northern part as reported by (Tamornpark,2022) and (National Literacy Survey 2010).

Findings showing that a greater number of study participants had an income of between ₦30,000/$39 -100,000/$130. This is because the present minimum wage of the country is set at ₦30,000 ($39) per month (wage indicator, 2023). The index study revealed a statistically significant difference in the distribution of complications ($p = 0.033$, $\chi^2 = 281$) and comorbidities ($p < 0.001$, $\chi^2 = 1022.13$). This comorbidity and complications have further affected participants quality of life. Some developed as complications due to chronic nature of type-2 DM (macrovascular and microvascular) while some are not related to diabetes. Complications reported are neuropathy 32.9%, nephropathy 6.6%, retinopathy 0.7%, neuropathy and retinopathy 1.3%. These were similar to what was observed by (Sendekie,*etal.* ,2022). These could be explained based on diabetes's effect on the kidney, causing scarring of the kidney which could lead to water retention and consequently result in raised blood pressure. Because diabetes is chronic, it could later affect the small blood vessels, arterioles, and venules causing stiffening and malfunction of the blood vessels which could further increase the chances of developing hypertension. Thus, diabetes patients are prone to nephropathy, neuropathy, and retinopathy as a result of damage to the blood vessels and nerves in organs such as the eyes.

The most prevalent comorbidity in this study was hypertension and related heart diseases, affecting 44.1% of the participants. Conversely, 31.6% of the participants reported no comorbidities or complications. The high prevalence of hypertension as a comorbidity observed in this study is consistent with findings from similar studies conducted in various regions of Nigeria.: Jos (Jelinek *et.al.,*2017) reported 63.8%; Uyo (Abubakar,2014) reported 40%; Ekiti (Okobiah,2020) reported 68.3%; Portharcout (Okpuruka *et.al.,* 2022) reported 89.5%; and in other Africa country, Uganda (Zare *et.al*,2020).reported 76.9%.Furthermore there was also an observed statistically significant difference in distribution of participants medication ($P < 0.001$, $\chi^2 = 1022.13$).

The socio-demographic information and clinical characteristics are both known as determinant of health-related quality of life. The effects of socio-demographic information on HRQOL were established by estimating the means of EQ-5D index scores and EQ-VAS scores across different categorical groups. The mean EQ-5D utility scores and overall mean EQ-VAS scores for this study are 0.7033±0.1525 and 63.57±17.16%; a similar study done in Berjand (Zare, et.al 2020). using the same instrument had 0.89 ± 0.13 and the mean score of EQ-VAS was 65.22 ± 9.32; a study in Northwest Ethiopia (Adibe, *et.al.,* 2018) had overall EQ-5D-5L utility and EQ-VAS scores to be 0.56 (±0.11) and 56.7 (±10.1) and study done in China (Wonget.al, 2020). had overall EQ-5D-5L utility and EQ-VAS scores to be 0.75±0.006, 69.25±0.63 respectively. The slight difference could be because health system, health expenditures per capita, political system, social culture, economic growth, and patient characteristics differ for different counties.

The results reveal a significant negative correlation between EQ-5D utility scores and age, such that scores decreased with increasing age ($r = -0.314$, $p = 0.016$), as confirmed by Pearson correlation analysis. This is consistent with the study done in Nigeria where an increase in age leads to a decrease in utility scores hence decrease in health-related quality of life (Abedini *et.al,* 2020). Also consistent with the study done in China (Issa and Baiyewu 2006). where different age groups 18-44, 45-64, and 65 above had EQ-5D utility mean scores 0.95±0.1, 0.98±0.17, 0.80±0.26 in decreasing order as age progresses, and the study done in Birjand (Allyhiani,*et.al.* ,2022) found mean score for quality of life in the older age groups to be lower than younger groups. The decreasing trend as the age progresses could be because as people age other chronic diseases and diabetes complications set in and since growth follow sigmoid curve, human body reaches maximum growth and starts declining/degenerating. In this study, employed participants had the best EQ-5D index mean score and EQ-VAS mean score while unemployed had the least. Pearson correlation is significant at p-value of 0.035. This similar to study done in Birjand (Allyhiani,*et.al.,* 2022) where employed people had the best utility score. Also, similar to study done in Iran where mean EQ-VAS scores were higher in employed subjects (Wong,*et.al.,* 2020). Employed patients in developing countries have more opportunities to have a better socioeconomic status but in Nigeria due to poor remuneration of government workers, self-employed people have a better socioeconomic status which is reflected in the utility and VAS scores.

Findings show participants with low income have the lowest EQ-5D utility mean scores and Pearson correlation is significant at a p-value of 0.025. This is consistent with studies done in Nigeria (Ashutosh *et.al.,* 2017).) where people with low income had poor quality of health.

Association between comorbidity and HRQOL using Pearson correlation shows strong negative correlation which is significant in participants with Neuropathy, and nephropathy and those participants with neuropathy and nephropathy.

Association between complication and HRQOL using Pearson correlation shows a strong negative correlation which is significant in most identified complications except in participants with Arthritis and those with chronic kidney disease combined hypertension. This shows that as HRQOL increased complication and comorbidity decreased.

This study shows that the majority of the participants are on combination of Biguanide and Sulphonyl urea (suphonylurea used as second line anti-diabetic). This is consistent with study done by (Sakamaki *et.al.,* 2006) and with (. Javanbakht *et.al.,* 2012).). This could be due to strong marketing, effectiveness, drug availability, high tolerability, promising effects, and price. The association between patients' anti-diabetic medications and HRQOL using Pearson correlation shows a strong positive correlation that is significant in all the nine categories of anti-diabetic prescription patterns identified in this study except for participants on Sulphonylurea as monotherapy, Biguanide combined with Sulponylurea and insulin, and participant on Biguanide combine withDPP-4. This could be a result of sulphonylurea being a monotherapy and the prices of insulin and DPP-4 which could cause non-adherence.

Productivity change is always in form of loss of activity in disease state. The study measures the loss of productivity in the participants. The mean percentage of time missed/absenteeism and Impairment of work/presenteeism are found to be 7.99% and 15.99% respectively. The mean percentage of overall work productivity lost (absenteeism presenteeism) is 24.89% and activity impairment/unpaid work is 33.62%. These findings are inconsistent with a study done in Turkey using the same instrument (Satman *et al.,* 2012) where the percentage work missed, impairment of work, overall work productivity, and activity impairment were found out to be 24%, 15% 39%, and 31% respectively. The difference in the value could be due to factors such as attitude to work, working conditions, employment age, wage, and environmental conditions which are different in the two countries.

Association between EQ-5D scores, EQ-VAS scores, and four outcomes of productivity loss was established using Spearman rank order correlation coefficient. EQ-5D and EQ-VAS show a significant strong negative correlation (p 0.000) for activity impairment and overall work productivity. The negative correlation indicates that as EQ-5D scores increase (participants attaining better health), activity impairment decreases and overall work productivity increases. This is because, in disease state, it's difficult to attain full potential. Also, time to visit the hospital to seek medical intervention results in the loss of reasonable hours of work.

According to recent data (Take-profit.org, 2023), the minimum wage in Nigeria is approximately $38.984 per month. This study found a mean overall work productivity loss (OWPL) of 24.89%, comprising both absenteeism and presenteeism. Based on this finding, the estimated monthly loss due to diabetes is approximately $9.703, representing 24.89% of the minimum monthly wage.

The estimated prevalence of Type II diabetes in Nigeria is approximately 5.7% of the country's population, which is projected to be 224,588,394 individuals (Àkànle., 2024).). This translates to a substantial burden of 12,801,538 individuals living with Type 2 diabetes mellitus in Nigeria.

The estimated monthly monetary loss in Nigeria due to Type II diabetes is approximately $124,213,323.214. This calculation is based on the average overall work productivity loss per individual ($9.703) multiplied by the estimated number of individuals living with Type II diabetes (12,801,538). On an annual basis, the total economic burden of Type II diabetes in Nigeria is estimated to be $1,490,559,878.56.

LIMITATION

The study population may not be fully representative of all individuals with type 2 diabetes, particularly those in rural or underserved areas

CONCLUSION

Type 2 Diabetes Mellitus (T2DM) significantly impairs health-related quality of life (HRQoL) and results in substantial productivity losses. This study highlights the crucial role of sociodemographic, clinical factors, and medications in determining HRQoL outcomes.

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