Alexandria Journal of Medicine 54 (2018) 111–118

HOSTED BY

Contents lists available at ScienceDirect

Alexandria Journal of Medicine

journal homepage: http://www.elsevier.com/locate/ajme

Original Article

Health-related quality of life and associated factors among patients with diabetes mellitus in Botswana

Godfrey Mutashambara Rwegerera [a,b,*], Thato Moshomo [c], Marea Gaenamong [d], Taibat Aderonke Oyewo [b], Sivasomnath Gollakota [b], Yordanka Piña Rivera [a,b], Anthony Masaka [e], Brian Godman [f,g], Meshack Shimwela [h], Dereje Habte [i]

[a] Faculty of Medicine, Department of Internal Medicine, University of Botswana, Botswana
[b] Department of Medicine, Princess Marina Hospital, Gaborone, Botswana
[c] Scottish Livingstone Hospital, Molepolole, Botswana
[d] Department of Accident and Emergency, Princess Marina Hospital, Gaborone, Botswana
[e] Botho University, Gaborone, Botswana
[f] Department of Laboratory Medicine, Division of Clinical Pharmacology, Karolinska Institutet, Karolinska University Hospital Huddinge, Stockholm, Sweden
[g] Strathclyde Institute of Pharmacy and Biomedical Sciences, University of Strathclyde, Glasgow, United Kingdom
[h] Amana Municipal Hospital, Dar-es-Salaam, Tanzania
[i] Management Sciences for Health (MSH), Addis Ababa, Ethiopia

ARTICLE INFO

Article history:
Received 25 April 2017
Accepted 20 May 2017
Available online 9 June 2017

Keywords:
Botswana
Diabetes mellitus
Health-related quality of life
Musculoskeletal disease

ABSTRACT

Background: Health-related quality of life (HRQOL) is an important aspect of diabetes mellitus care. The objective of the study was to determine the HRQOL of diabetes mellitus (DM) patients in Botswana as little known in Africa. *Materials and methods*: A cross-sectional study of 380 randomly selected DM patients in a tertiary clinic in Gaborone, Botswana was conducted to obtain Data on HRQOL and structured questionnaire was used to collect information on sociodemographic and clinical characteristics. Multivariate logistic regression to determine sociodemographic and clinical characteristics associated. *Results*: Majority of patients were female with no formal education or primary level of education. Mean HbA1c was 7.97% (SD: 2.02) and most patients had poor glycemic control. The majority had both worse physical composite score (PCS-12) and mental composite score (MCS-12), with worse proportions of the two. Female gender, older age ≥65 years, and the presence of three or more documented diabetic complications were associated with significant worse PCS-12. Presence of two diabetic complications, three or more diabetic complications, and musculoskeletal disease were associated with significant MCS-12. *Conclusions:* Diabetic patients in Botswana have relatively poor HRQOL. The fact that most patients present late with complications calls for policy attention to diagnose diabetes mellitus early and prevent associated complications, ultimately improving health-related quality of life among diabetes mellitus patients.

1. Introduction

Diabetes mellitus (DM) is a disease of global public health importance associated with high morbidity and mortality.[1,2] According to International Diabetes Federation report of 2015, about 415 million people have DM globally with the figure projected to have increased to 642 million by 2040 or maybe even doubled by the year 2040.[3,4] The greatest increase will be in developing countries (69%) compared with developed countries (20%),[5] with non-communicable disease (NCDs) accounting for up to 80% of deaths among developing countries.[6] In Botswana, the prevalence of DM among adults (20–79 years) is approximately 52 per 1000 people out of which 31.6 per 1000 remain undiagnosed.[3]

Health-related quality of life (HRQOL) refers to the physical, psychological and social aspects of health that are influenced by person's experience on beliefs, expectations and perceptions. Understanding these domains by health care workers has an

Peer review under responsibility of Alexandria University Faculty of Medicine.
* Corresponding author at: Department of Internal Medicine, Faculty of Medicine, University of Botswana, Botswana.
E-mail addresses: grwege@yahoo.com (G.M. Rwegerera), moshomotkl@gmail.com (T. Moshomo), mareagaenamong@gmail.com (M. Gaenamong), aderonkeo@yahoo.co.uk (T.A. Oyewo), siv_vagv@yahoo.com (S. Gollakota), yordankapr@yahoo.com (Y.P. Rivera), masakaanthony@gmail.com (A. Masaka), Brian.Godman@ki.se, Brian.godman@strath.ac.uk (B. Godman), mshimwela@gmail.com (M. Shimwela), derejehabte@yahoo.com (D. Habte).

http://dx.doi.org/10.1016/j.ajme.2017.05.010
2090-5068/

advantage in terms of incorporating chronic disease management strategies into routine care, leading to a reduction of both morbidity and mortality, including patients in developing countries.[7–12] The psychosocial burden of living with diabetes mellitus is considerable as it affects self-care behaviors, leading to long term poor glycemic control, increased risk of long-term complications and poor quality of life.[9,13–15] Understanding the measurements of HRQOL as well as the factors associated with poor quality of life has a benefit in terms of improving the physical and psychosocial burden associated with DM, ultimately reducing associated costs, morbidity and mortality.[15,16]

Published studies have found that DM patients without complications have higher overall utility values than those with complications.[17] Currently, most of the published literature on HRQOL of patients with DM is based on developed countries with little known among developing countries. Whilst it is well acknowledged that there is better access to health in developed countries compared to developing countries, there are more associated morbidities of DM in developing countries,[9] which will have a considerable impact on their HRQOL.[12,18] Consequently, we sought to determine the HRQOL, and associated sociodemographic and clinical variables, among patients with DM in Botswana. The findings will be used to suggest future strategies in Botswana to improve the management of these patients if pertinent. The findings may also be of interest to other African countries with increasing rates of NCDs including diabetes.

2. Methods

2.1. Study area, design and participants recruitment

Details of study area, design and participants recruitment, inclusion and exclusion criteria and how sociodemographic and clinical data was collected have been described in details elsewhere,[19] In summary, a cross-sectional study was conducted whereby 380 patients were randomly selected for the purpose of this study between July to September 2015 in Block 6 clinic, a tertiary unit in Gaborone, Botswana, and data was obtained by means of standard structured questionnaire interviews, Further data was obtained from patients' hospital charts. This clinic was chosen as it offers services to over 3000 diabetic patients. In Botswana, medicines are provided free-of-charge to patients; consequently, co-payment for medicines is not an issue.[19] On average 1800 to 2000 diabetic patients visit the clinic monthly.

2.2. Sample size

The sample size was calculated from the formula of descriptive cross-sectional study, i.e. $N = Z^2\ p\ (100 - p)/d^2$; where: N = estimated minimum sample size, Z = Standard deviation of 1.96 at 95% confidence interval, p = Response rate to the SF-12 quality of life questionnaire in the outpatient clinic[20] which was 44.3%, and d = the margin of error on p, which is approximately 0.05. Consequently, $N = 1.96 \times 1.96 \times 44.3 \times 55.7/25$, = 379.

As seen, the estimated minimum sample size was 379 patients.

2.3. Study instrument

The most widely used generic measure of quality of life in studies of people with diabetes mellitus is the Medical Outcomes Study (MOS) Short-Form General Health Survey, which has several forms (SF-36, SF-20, and SF-12). The MOS instrument includes physical, social and role functioning scales to capture behavioral dysfunction, and this instrument has been shown to reflect more subjectively components of health and well-being.[21]

We chose to use Social factor (SF-12) as a tool to measure health related quality of life because it has been shown to be as effective as SF-36. The tool (SF-12), is brief and convenient to use.[22–27] Whilst we did not find studies using SF-12 scores among patients with diabetes mellitus in Botswana, SF-12 has been used several times to assess HRQOL among patients with chronic diseases in the Republic of South Africa.[28–30] Consequently, in view of the proximity of two countries and both have public healthcare systems, we saw it as justifiable to select this tool for our study. Both countries also have a high prevalence of Human Immunodeficiency Virus (HIV). In Botswana, over 22% of the adult population have HIV, with higher rates especially among women.[31] Consequently, considerable opportunity for co-morbidity of diabetes among these patients.

Specifically, we used the short form of the widely used SF-36 called SF-12v2™ Health Survey (SF-12; Quality Metric Inc., Lincoln, RI, USA). The SF-12v2™ is a brief and reliable measure of overall health status.[32] It measures eight domains of health; physical functioning, role limitations because of physical health (role-physical), bodily pain, general health perceptions, vitality, social functioning, role limitations because of emotional problems (role-emotional) and mental health.[32] The information is then scored by the scale from 0 to 100 on each of the domains, as well as for the Physical Component Summary (PCS-12) scale and Mental Component Summary (MCS-12).[33] We entered the responses of SF-12 for each patient into the SF website (www.sf-36.org/SF-12.html). The website computes the scores of PCS-12 and MCS-12 into the range 0–100, whereby 0 indicates the lowest composite score and 100 the highest composite score. The outcome variables in our study were; the worse physical composite score and worse mental composite score.

We did not conduct separate analysis for Type 1 or Type 2 diabetes, similar to other studies,[12] as the vast majority of patients in Botswana attending clinics such as this one are Type 2. The majority of Type 1 patients in Botswana continue to attend pediatric and adolescent clinics at the National hospital. Consequently, it was perceived that undertaking a separate analysis for the two types of diabetes would be difficult to interpret; consequently, we combined these two types of diabetes mellitus for the study. However, we did assess the two types of diabetes as an independent variable.

2.4. Dependent variables

We measured both the worse PCS-12 and worse MCS-12 as a score of <50%, and the better PCS and MCS as the scores of ≥50%. Our outcome (dependent) variables were worse PCS-12 and worse MCS-12.

The choice of 50% cut off is based on the fact that the scores that are summarized above or equal to 50% are categorized as better health status and those below 50% are categorized to have a worse health status.[34–37]

2.5. Independent variables

Our independent sociodemographic variables were; age, gender, marital status and level of education. We also measured weight and height to determine the Body Mass Index (BMI). Glycemic control was determined by extracting results of within past three months of HbA1c from Integrated Patients Management System (IPMS) and defined as good (<7%) and poor (≥7%).

We also calculated the average blood pressure in the last 3 visits, and documented the HIV status as recorded either in the

patients' charts or IPMS within the past year. Other independent variables included the duration of suffering from diabetes, type of diabetes, the regimen used to treat the diabetes, presence or absence of documented diabetic complications and presence or absence of documented musculoskeletal disease. For the purpose of this study, musculoskeletal disease was categorized as diseases of the muscle, bone or joints associated with pain, stiffness and limited mobility and involving or affecting gait, arms, legs and spine (GALS).[38,39]

2.6. Data analysis

We used the SPSS version 22 statistical software for the analysis calculated the inferential statistics for proportions of worse outcomes for both sociodemographic and clinical characteristics. A multivariate logistic regression analysis was undertaken to determine the association of worse composite scores (PCS or MCS) and the factors which were found to be statistically significant in the bivariate analysis. A p-value of less than 0.05 was considered statistically significant.

2.7. Ethical clearance

The permission to conduct the study was obtained from the University of Botswana Ethics Committee and the Institutional Review Board (IRB) and Ethics Committee at Princess Marina Hospital. Ethical clearance was secured from the Botswana Ministry of Health Research Unit and all the patients signed informed consent.

3. Results

3.1. Sociodemographic and clinical characteristics of study participants

Details of sociodemographic characteristics and clinical characteristics of the study population have been described elsewhere.[19] In this study, four more patients who were on diet were included in the analysis making a total of 380 patients. The majority were female with no formal education or primary level of education (Table 1).

The mean HbA1c of participants was 7.97% (SD: 2.02) and 60.1% of patients had poor glycemic control (HbA1c $\geq$ 7%). Among the HIV positive patients, 63.6% had CD4 counts above 500 µmol/l and mean CD4 of 641.58 (SD: 302.20). The majority of study participants (57.4%) had uncontrolled hypertension (Table 1).

3.2. Health-related quality of life of study participants

The majority of study participants had both worse physical composite score (PCS-12) and mental composite score (MCS-12); with worse proportions of the two accounting for 59.7% and 55.3% respectively. Likewise, the overall mean scores for both PCS-12 and MCS-12 were below 50% (Table 2).

3.3. Association between health-related quality of life and sociodemographic and clinical characteristics

Results of descriptive sociodemographic and clinical groups for PCS-12 and MCS-12 are shown in Table 3. Factors associated with significant worse PCS-12 in the bivariate analysis were female gender, older age, primary or no formal education, being married/divorced/widowed/separated, type of DM, duration of DM, presence of DM complications, uncontrolled hypertension and presence documented musculoskeletal disease. On the other hand; Body Mass Index (BMI), modality of treatment, glycemic control and HIV status were not associated with PCS-12.

Table 1
Socio-demographic and clinical characteristics of study participants.

Variable	Frequency (%)
Gender	
Male	116 (30.5%)
Female	264 (69.5%)
Age	
Up to 54	159 (41.8%)
55–64	106 (27.9%)
65 years and more	115 (30.3%)
Level of education	
No formal education	70 (18.4%)
Any primary school	181 (47.6%)
Secondary and above	129 (33.9%)
Marital status	
Never married	102 (26.8%)
Currently married	157 (41.3%)
Others	121 (31.8%)
Body Mass Index	
None obese (< 30 kg/m^2)	168 (50.0%)
Obese ($\geq$ 30 kg/m^2)	168 (50.0%)
Duration of diabetes (years)	
< 5	178 (49.2%)
5–10	91 (25.1%)
> 10	93 (25.7%)
Type of diabetes	
Type 1	23 (6.1%)
Type 2	357 (93.9%)
Modality of treatment	
Diet	4 (1.1%)
Oral hypoglycemic agents (OHA)	224 (58.9%)
Insulin	51 (13.4%)
Both OHA and Insulin	101 (26.6%)
Glycemic control (HbA1C)	
Normal (< 7%)	147 (39.9%)
Poor ($\geq$ 7%)	221 (60.1%)
Presence of DM complications	
Yes	311 (81.8%)
No	69 (18.2%)
HIV status within past 1 year	
Positive	38 (10.0%)
Negative	235 (61.8%)
Don't know	107 (28.2%)
CD4 (only for HIV positive)[a]	
Up to 500	12 (36.4%)
Over 500	21 (63.6%)
Average Blood Pressure (mmHg)	
<140/90	162 (42.6%)
≥140/90	218 (57.4%)
Presence of musculoskeletal disease	
Yes	62 (16.4%)
No	316 (83.6%)

[a] Missing 5 CD4 values.

Table 2
Overall health related quality of life.

Variable	Frequency (%)	Mean ± SD (Range)
Physical Composite score (PCS-12)		44.39 ± 10.67 (16.2–63.7)
Below average (<50%)	227 (59.7%)	
Above average (≥50%)	153 (40.3%)	
Mental Composite score (MCS-12)		45.96 ± 10.57 (17.4–63.4)
Below average (<50%)	210 (55.3%)	
Above average (≥50%)	170 (44.7%)	

Table 3
Association of health related quality of life and sociodemographic and clinical variables.

Variables	PCS < 50%	PCS ≥ 50%	P-value	MCS < 50%	MCS ≥ 50%	P-value
Gender			0.000			0.041
Male	53 (45.7%)	63 (54.3%)		55 (45.4%)	61 (52.6%)	
Female	174 (65.9%)	90 (34.1%)		155 (58.7%)	109 (41.3%)	
Age			0.000			0.000
Up to 54	66 (41.5%)	93 (58.5%)		75 (47.2%)	84 (52.8%)	
55–64	71 (67.0%)	35 (33.0%)		52 (49.1%)	54 (50.9%)	
65 years and more	90 (78.3%)	25 (21.7%)		83 (72.2%)	32 (27.8%)	
Level of education			0.000			0.001
No formal education	55 (78.6%)	15 (21.4%)		46 (65.7%)	24 (34.3%)	
Any primary school	115 (63.5%)	66 (36.5%)		109 (60.2%)	72 (39.8%)	
Secondary and above	57 (44.2%)	72 (55.8%)		55 (42.6%)	74 (57.4%)	
Marital status			0.000			0.000
Never married	44 (43.1%)	58 (56.9%)		42 (41.2%)	60 (58.8%)	
Currently married	100 (63.7%)	57 (36.3%)		86 (54.8%)	71 (45.2%)	
Others	83 (68.6%)	38 (31.4%)		82 (67.8%)	39 (32.3%)	
Body Mass Index			0.374			0.442
None obese (<30 kg/m^2)	96 (57.1%)	72 (42.9%)		90 (53.6%)	78 (46.4%)	
Obese (≥30 kg/m^2)	104 (61.9%)	64 (38.1%)		97 (57.7%)	71 (42.3%)	
Duration of diabetes (years)			0.003			0.053
<5	90 (50.6%)	88 (49.4%)		93 (52.2%)	85 (47.8%)	
5–10	55 (60.4%	36 (39.6%)		45 (49.5%)	46 (50.5%)	
>10	67 (72.0%)	26 (28.0%)		61 (65.6%)	32 (34.4%)	
Type of diabetes			0.000	10 (43.5%)	13 (56.5%)	0.241
Type 1	4 (17.4%)	19 (82.6%)				
Type 2	223 (62.5%)	134 (37.5%)		200 (56.0%)	157 (44.0%)	
Modality of treatment			0.337			0.719
Oral hypoglycemic agents (OHA)	134 (59.8%)	90 (40.2%)		120 (53.6%)	104 (46.4%)	
Insulin	26 (51.0%)	25 (49.0%)		28 (54.9%)	23 (45.1%)	
Both OHA and Insulin	64 (63.4%)	37 (36.6%)		59 (58.4%)	42 (41.6%)	
Glycemic control (HbA1C)			0.808			0.883
Normal (<7%)	89 (60.5%)	58 (39.5%)		80 (54.4%)	67 (45.6%)	
Poor (≥7%)	131(59.3%)	90 (40.7%)		122 (55.2%)	99 (44.8%)	
Presence of DM complications			0.000			0.000
Yes	205 (65.9%)	106 (34.1%)		192 (61.7%)	119 (38.3%)	
No	22 (31.9%)	47 (68.1%)		18 (26.1%)	51 (73.9%)	
HIV status within past 1 year			0.181			0.044
Positive	18 (47.4%)	20 (52.6%)		15 (39.5%)	23 (60.5%)	
Negative	140 (59.6%)	95 (40.4%)		128 (54.5%)	107 (45.5%)	
Don't know	69 (64.5%)	38 (35.5%		67 (62.6%)	40 (37.4%)	
Average Blood Pressure (mmHg)						0.028
<140/90	82 (50.6%)	80 (49.4%)	0.002	79 (50.6%)	83 (49.4%)	
≥140/90	145 (66.5%)	73 (33.5%)		131 (66.5%)	87 (33.5%)	
Presence of musculoskeletal disease						0.000
Yes	51 (82.3%)	11 (17.7%)	0.000	51 (82.3%)	11 (17.7%)	
No	174 (55.1%)	142 (44.9%)		158 (50.0%)	158 (50.0%)	

As regards MCS-12, the factors associated with significant worse scores included female gender, older age, being single/divo rced/separated/widowed, the presence of DM complications, HIV status, uncontrolled hypertension and the presence of musculoskeletal disease.

Body Mass Index (BMI), duration of DM, modality of treatment and glycemic control were not associated with MCS-12 in bivariate analysis (Table 3).

3.4. Multivariate logistic regression analysis of factors associated with worse physical composite score (PCS-12)

Among the sociodemographic and clinical variables studied, only female gender (p-value = 0.023, AOR = 1.95; 95% CI = 1.09, 3.48), older age ≥ 65 years (p-value = 0.015, AOR = 2.43; 95% CI = 1.18, 4.99). The presence of three or more documented diabetic complications (p-value = 0.002, AOR = 3.47; 95% CI = 1.56, 7.71) were associated with significant worse physical composite scores in multivariate analysis (Table 4).

3.5. Multivariate logistic regression analysis of factors associated with worse mental composite score (MCS-12)

In multivariate logistic regression analysis, worse mental health scores were significantly associated with the presence of two diabetic complications (p-value = 0.028, AOR = 2.40; 95% CI = 1.09, 5.26), three or more diabetic complications (p-value = 0.000, AOR = 5.37; 95% CI = 2.41, 11.96) and the presence of documented musculoskeletal disease (p-value = 0.020, AOR = 2.52; 95% CI = 1.15, 5.52).

On the other hand, gender, age, level of education, marital status, Body Mass Index, HIV status and modality of treatment were not associated with significant worse MCS-12 scores in the multivariate analysis (Table 5).

3.6. Health-related quality of life association among HIV positive patients

Results of recent CD4 counts were available for 33/38 (86.8%) of known HIV positive patients. The association between CD4 level

Table 4
Multivariate logistic regression analysis of factors associated with below average PCS-12.

Variables	Adjusted odds ratio (95% CI)	P-value
Gender		
Male	Reference	
Female	**1.95 (1.09, 3.48)**	**0.023**
Age in years		
21–54	Reference	
55–64	1.67 (0.86, 3.22)	0.127
65 & above	**2.43 (1.18, 4.99)**	**0.015**
Level of education		
No formal education	2.01 (0.84, 4.84)	0.116
Any primary education	1.10 (0.59, 2.04)	0.747
Secondary and above	Reference	
Marital status		
Never married	Reference	
Currently married	1.37 (0.70, 2.66)	0.346
Others	1.60 (0.80, 3.20)	0.182
BMI		
Non-obese (<30 kg/m^2)	Reference	
Obese (≥30 kg/m^2)	0.97 (0.57, 1.65)	0.917
Type of DM		
Type 1	Reference	
Type 2	1.38 (0.24–7.78)	0.715
Documented diabetes complications		
None	Reference	
One	1.30 (0.59, 2.86)	0.511
Two	2.14 (0.97, 4.72)	0.058
Three or more	**3.47 (1.56, 7.71)**	**0.002**
HIV status		
Positive	Reference	
Negative	0.89 (0.38, 2.06)	0.795
Unknown	0.68 (0.26, 1.74)	0.425
Average BP measurement		
Controlled (<140/90 mmHg)	Reference	
Uncontrolled (≥140/90 mmHg)	1.14 (0.67, 1.94)	0.617
Type of medication		
OHA	Reference	
Insulin	1.00 (0.42, 2.37)	0.984
Both	1.18 (0.65, 2.13)	0.586
Muskulo-skeletal disease		
Yes	1.79 (0.81, 3.93)	0.147
No	Reference	

Table 5
Multivariate logistic regression analysis of factors associated with below average MCS-12.

Variables	Adjusted odds ratio (95% CI)	P-value
Gender		
Male	Reference	
Female	1.19 (0.68, 2.11)	0.530
Age in years		
21–54	Reference	
55–64	0.56 (0.29, 1.08)	0.085
65 & above	1.26 (0.61, 2.58)	0.526
Level of education		
No formal education	1.68 (0.72, 3.90)	0.223
Any primary education	1.53 (0.82, 2.85)	0.172
Secondary and above	Reference	
Marital status		
Never married	Reference	
Currently married	1.01 (0.52, 1.95)	0.969
Others	1.58 (0.79, 3.13)	0.190
BMI		
Non-obese (<30 kg/m^2)	Reference	
Obese (≥30 kg/m^2)	1.10 (0.65, 1.85)	0.707
Documented diabetes complications		
None	Reference	
One	1.98 (0.90, 4.38)	0.089
Two	**2.40 (1.09, 5.26)**	**0.028**
Three or more	**5.37 (2.41, 11.96)**	**0.000**
HIV status		
Positive	Reference	
Negative	1.28 (0.55, 2.97)	0.551
Unknown	1.73 (0.67, 4.43)	0.250
Average BP measurement		
Controlled (<140/90 mmHg)	Reference	
Uncontrolled (≥140/90 mmHg)	0.92 (0.54, 1.56)	0.776
Type of medication		
OHA	Reference	
Insulin	1.78 (0.77, 4.09)	0.170
Both	1.37 (0.76, 2.47)	0.284
Muskulo-skeletal disease		
Yes	**2.52(1.15, 5.52)**	**0.020**
No	Reference	

Table 6
Health related quality of life association with CD4 among HIV positive patients.

	CD4 up to 500 (%)	CD4 over 500	p-value
PCS-12			1.00
<50% below average	5 (41.7%)	10 (47.6%)	
≥50% above average	7 (58.3%)	11 (52.4%)	
MCS-12			0.46
<50% below average	3 (25.0%)	9 (42.9%)	
≥50% above average	9 (75.0%)	12 (57.1%)	

Mean CD4 is 641.58 μmol/l.

and HRQOL for both worse PCS-12 and worse MCS-12 did not reveal any significance with p-values of 1.00 and 0.46 respectively (Table 6).

4. Discussion

The overall HRQOL of our study participants was worse than the average population (Table 2). This is consistent with other studies researching quality of life among diabetic patients.[12,40–43] Most of the published studies have shown female gender and older age to be associated with overall worse health-related quality of life scores.[9,16,43–49] These findings are similar to our study for the physical composite score (PCS-12) where female gender was significantly associated with worse scores in the multivariate analysis (Table 4).

Older age was associated with worse PCS-12 and MCS-12 in the bivariate analysis (Table 3); however, during multivariate analysis only worse physical composite score was associated older age in our study (Tables 4 and 5), which is similar to findings found elsewhere[9,50] Marital status has also been shown to influence HRQOL in previous studies. According to Jacobson et al.[51], it has been shown that single and married people had better quality of life than those who were divorced/separated. However, a study in Greece found contrasting results with being single associated with worse HRQOL.[52] In our study, we found that being single was associated with better quality of life both for PCS-12 and MCS-12 during bivariate analysis (Table 3); however, marital status had no influence on quality of life during multivariate analysis (Tables 4 and 5).

Previous studies have shown inconsistent findings of the duration of DM on quality of life, with some studies showing that long duration is associated with decreased quality of life[16,47,53,54] whilst others showed no association.[12,55,56] Our study also found no

association between duration of DM and HRQOL in both PCS-12 and MCS-12 (Tables 4 and 5). The lack of association between duration of DM and quality of life in this study is rather surprising considering the fact that older age, which was significantly associated with worse PCS-12 in our study (Table 4), is presumably associated with a longer duration of DM. This lack of association could be due to the fact that our study cohort consisted mostly of patients diagnosed recently (shorter duration of DM) with complications.

Our study also showed that a lower level of education, namely no formal education and primary education, were associated with worse HRQOL outcomes for both PCS-12 and MCS-12 in bivariate analysis (Table 3); which is similar to previous studies.[16,57] However, the findings in multivariate analysis were not significant (Tables 4 and 5).

Higher Body mass index (BMI) has been shown to be associated with a higher number of chronic and somatic illnesses and subsequently decreased physical health-related quality of life.[56] Most of the previous studies have consistently shown that increased BMI is associated negatively with both PCS-12[20,36,58–63] and MCS-12.[20,59,62–65] Our study cohort consisted of over 75% of patients who were either overweight or obese; however, we did not find any association between HRQOL (both PCS-12 and MCS-12) and body mass index (Table 3). This lack of association is similar to previous studies.[9,66,67] One possible reasons may be that overweight and obesity are linked to multifactorial aetiologies such as genetic, metabolic, behavioral, social and cultural issues and the SF-12 instrument may not be the most sensitive instrument to determine any association between HRQOL and BMI.[68,69]

The results of previous studies comparing HRQOL and modalities of treatment have produced contrasting results. In studies involving both patients with Type 1 and Type 2 DM; the use of insulin injections was associated with worse quality of life.[20,36,49,68] and patients on combination of oral hypoglycemic agents (OHA) and insulin had better quality of life than those on insulin alone in a study of type 2 DM patients.[57] Our study though did not find any association between the modality of treatment and HRQOL. One of the possible reason may be that patients with Type 1 and 2 diabetes have different expressions in their quality of life and our study only had a limited number 23/380 (6.1%) of patients with Type 1 DM which may not be sufficient to detect any changes. Another study with large sample size of Type 1 DM is necessary to provide more conclusive results in this aspect.

Clinically, it can be extrapolated that for diabetes mellitus patients poor glycemic control will be associated with both increased prevalence and incidence of macrovascular and microvascular complications, ultimately leading decreased HRQOL.[58,70–72] However, studies have produced contrasting results, with some showing poor glycemic control to be associated with worse HRQOL[47,54,73] whilst others found no association.[74–77] Our study did not find an association between glycemic control and HRQOL.

Previous studies consistently showed that quality of life is negatively associated increased number of diabetes mellitus complications.[16,36,52,57,74,78,79] Our study also revealed similar findings with number of DM complications significantly associated with both worse PCS-12 and MCS-12 (Table 3).

Diabetes mellitus is associated with variety of musculoskeletal diseases; the latter being correlated with longer duration of DM and poor metabolic control. Musculoskeletal diseases in DM have been previously associated worse HRQOL.[39,80,81] We sought to find an association between documented musculoskeletal diseases and HRQOL among our study participants. However, whilst we expected that patients with musculoskeletal disease to have worse PCS-12, this was not seen. The presence of documented musculoskeletal disease was though significantly associated with worse mental composite scores (Table 5). This needs further investigation to determine how musculosketal disease actual impacts on the quality of life of these patients.

Diabetes mellitus and HIV disease are both chronic conditions associated with worse HRQOL in terms of physical and mental health status.[82,83] As for HIV, lower CD4 is associated with opportunistic infections and higher morbidity and mortality.[83] Consequently, it was expected that DM patients with coexisting HIV disease would have depicted worse HRQOL outcomes. However, we found no association between HIV status and HRQOL regardless of CD4 levels (Table 6). Previous studies have shown that being on Antiretroviral treatment (ART) regardless of immunosuppression status results in improved health-related quality of life scores.[84,85] Whilst it was not the intention of this study to determine ART status, all the HIV positive patients in our study were on ART, and their CD4 counts were high (mean CD4 = 641.58 μmol/l) – Table 1; hence less likelihood of associated HIV conditions. There is a need to carry further studies among large cohort of DM patients who are HIV positive to verify our findings. This is particularly important given the extra pill burden with these patients, and potential additional impact on adherence.

5. Study limitations

The results of this study are very important; however they need to be interpreted on the background of several limitations. Firstly, our study being a cross-sectional study in design; it only provides association and not causation. Secondly, though we analyzed both sociodemographic and clinical variables, including complications and musculoskeletal disease, we did not assess health behavioral factors such as diabetes-self management, alcohol drinking and smoking. These variables might also have had an impact on multivariate analysis. Thirdly, our clinic being a tertiary clinic may be presumed to have patients with more complications and subsequent worse quality of life outcomes; however, it should be clear that the clinic serves in the capacities of primary, secondary and tertiary care making results representative of diabetic patients in Botswana. Consequently despite these limitations, we believe our findings are robust providing direction for the future to improve the care of these patients.

6. Conclusions

The study findings indicate that diabetic patients in Botswana have relatively poor HQOL affecting both physical and mental-well-being. Female gender and older age was associated with worse physical composite scores. Musculoskeletal disease was associated with worse mental composite scores. On the other hand, increased number of diabetic complications was associated with worse scores for both physical and mental composite scores. The fact that most patients present late with complications calls for attention to set policies that help diagnose diabetes mellitus earlier and prevent associated complications, ultimately improving health-related quality of life among diabetes mellitus patients. This potentially includes programmes around self-management as well medication adherence if this proves to be a problem. These are subject areas for the future.

References

1. Wee H-L, Cheung Y-B, Li S-C, Fong K-Y, Thumboo J. The impact of diabetes mellitus and other chronic medical conditions on health-related quality of life: is the whole greater than the sum of its parts? *Health Qual Life Outcomes*. 2005;3:2.
2. Smith LL, Burnet SP, McNeil JD. Musculoskeletal manifestations of diabetes mellitus. *Br J Sports Med*. 2003;37(1):30–35.
3. International Diabetes Federation on Botswana. <http://www.idf.org/membership/afr/botswana>. Accessed on 26th February 2017; 2015.

4. IDF. IDF diabetes atlas: global estimates of the prevalence of diabetes for 2015 and 2040. Available at URL: <http://www.diabetesatlas.org/>.
5. Shaw JE, Sicree RA, Zimmet PZ. Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Res Clin Pract*. 2010;87(1):4–14.
6. Riaz H, Godman B, Bashir S, et al.. Evaluation of drug use indicators for non-communicable diseases in Pakistan. *Acta poloniae pharmaceutica*. 2016;73 (3):787–794.
7. Camacho F, Anderson RT, Bell RA, et al.. Investigating correlates of health related quality of life in low-income sample of patients with diabetes. *Qual Life Res*. 2002;11:783–796.
8. Genovese S, Tedeschi D. Effects of vildagliptin/metformin therapy on patient reported outcomes: work productivity, patient satisfaction, and resource utilization. *Adv Ther*. 2013;30:152–164.
9. Rubin RR, Peyrot M. Quality of life and diabetes. *Diabetes/Metabolism Res Rev*. 1999;15(2):205–218.
10. Ose D, Wensing M, Szecrenyi J, Joos S, Hermann K, Miksch A. Impact of primary care-based disease management on the health-related quality of life in patients with type 2 diabetes and comorbidity. *Diabetes Care*. 2009;32: 1954–1956.
11. Speight J, Reaney MD, Barnard KD. Not all roads lead to Rome – a review of quality of life measurement in adults with diabetes. *Diabet Med*. 2009;26:315–327.
12. da Mata AR, Alvares J, Diniz LM, et al.. Quality of life of patients with diabetes mellitus types 1 and 2 from a referal health centre in Minas Gerais, Brazil. *Expert Rev Clin Pharmacol*. 2016;9(5):739–746.
13. Fisher EB Jr, Arfken CL, Heins J, et al. Acceptance of diabetes in adults. In: Gochman DS, ed. *Handbook of Health Behavior Research*, New York: Plenum Publishing Corp; 1996.
14. Glasgow RE, Osteen VL. Evaluating diabetes education: are we measuring the most important outcomes? *Diabetes Care*. 1992;15:1423–1432.
15. Rosenthal MJ, Fajardo M, Gilmore S, Morley JE, Nabiloff BD. Hospitalization and mortality of diabetes in older adults: a three-year prospective study. *Diabetes Care*. 1998;21:231–235.
16. Glasgow RE, Ruggiero L, Eakin EG, Dryfoos J, Chobanian L. Quality of life and associated characteristics in a large national sample of adults with diabetes. *Diabetes Care*. 1997;20(8):562–567.
17. Solli O, Stavem K, Kristiansen IS. Health-related quality of life in diabetes: the associations of complications with EQ-5D scores. *Health Qual Life Outcomes*. 2010;8:18.
18. Garratt AM, Schmidt L, Fitzpatrick R. Patient-assessed health outcome measures for diabetes: a structured review. *Diabet Med*. 2002;19:1–11.
19. Rwegerera GM, Moshomo T, Gaenamong M, et al.. Antidiabetic medication adherence and associated factors among patients in Botswana; implications for the future. *Alex J Med*. 2018;54(2):103–109. http://dx.doi.org/10.1016/j.ajme.2017.01.005.
20. Sundaram M, Kavookjian J, Patrick JH, et al.. Quality of life, health status and clinical outcomes in type 2 diabetes patients. *Qual Life Res*. 2007;16 (2):165–177.
21. Jacobson AM. Quality of life in patients with diabetes mellitus. *Semin Clin Neuropsychiatry*. 1997;2:82–93.
22. Sugar CA, Sturm R, Lee TT, et al.. Empirically defined health states for depression from the SF-12. *Health Serv Res*. 1998;33(4):911–928.
23. Gandek B, Ware JE, Aaronson NK, et al.. Cross-validation of item selection and scoring for the SF-12 health survey in nine countries: results from the IQOLA project. *J Clin Epidemiol*. 1998;51(11):1171–1178.
24. Jenkinson C, Layte R, Jenkinson D, et al.. A shorter form health survey: can the SF-12 Replicate results from the SF-36 in longitudinal studies? *J Public Health Med*. 1997;19(2):179–186.
25. Lim LL, Fisher JD. Use of the 12-item short-form (SF-12) health survey in an australian heart and stroke population. *Qual Life Res*. 1999;8(1–2):1–8.
26. Lundberg L, Johannesson M, Isacson DGL, Borgquist L. The relationship between health-state utilities and the SF-12 in a general population. *Med Decis Mak*. 1999;19(2):128–140.
27. Ware Jr JE, Kosinski M, Keller SD. A 12-item short-form health survey: construction of scales and preliminary tests of reliability and validity. *Med Care*. 1996;34(3):220–233.
28. Mbada CE, Onayemi O, Ogunmoyole Y, Johnson OE, Akosile CO. Health-related quality of life and physical functioning in people living with HIV/AIDS: a case–control design. *Health Qual Life Outcomes*. 2013;11:106.
29. Peltzer K, Pengpid S. Alcohol use and health-related quality of life among hospital outpatients in South Africa. *Alcohol*. 2012;47(3):291–295.
30. Westaway MS. The impact of chronic diseases on the health and well-being of South Africans in early and later old age. *Arch Gerontol Geriatr*. 2010;50 (2):213–221.
31. UNAIDS. Prevention Gap report 2016. Available at URL: <http://www.unaids.org/sites/default/files/media_asset/2016-prevention-gap-report_en.pdf>.
32. Ware JE, Kosinski M, Dewey JE. *How to score version two of the SF-36 health survey*. Lincoln, RI: Quality Metric, Incorporated; 2000.
33. 1 Utah Health Status Survey, Utah Department of Health Interpreting the SF-12. <http://www.health.utah.gov/opha/publications/2001hss/sf12/SF12_Interpreting.pdf>. Last accessed on 24th February 2017.
34. Anderson RT, Narayan KM, Feeney P, et al.. Sullivan MD; action to control cardiovascular risk in diabetes (ACCORD) investigators. Effect of intensive glycemic lowering on health-related quality of life in type 2 diabetes: ACCORD trial. *Diabetes Care*. 2011;34(4):807–812.
35. Rehab Measures: short form 12 item (version 2) health survey <http://www.rehabmeasures.org/Lists/RehabMeasures/DispForm.aspx?ID=1149>.
36. Bourdel-Marchasson I, Druet C, Helmer C, et al.. Correlates of health-related quality of life in French people with type 2 diabetes. *Diabetes Res Clin Pract*. 2013;101(2):226–235.
37. Ware J, Kosinski M, Keller S. *SF-12: how to score the SF-12 physical and mental health summary scales*. 2nd ed. Boston: The Health Institute, New England Medical Center; 1995.
38. Hordon LD. Musculoskeletal complications in diabetes mellitus. <https://www.uptodate.com/contents/musculoskeletal-complications-in-diabetes-mellitus>. Last accessed on 28th February 2017.
39. Silva MBG, Skare TL. Musculoskeletal disorders in diabetes mellitus. *Rev Bras Reumatol*. 2012;52(4):594–609.
40. Al-Shehri FS. Quality of life among saudi diabetics. *J Diabetes Mellitus* 2014;4:225–231.
41. Reddy SS. Health outcomes in type 2 diabetes. *Int J Clin Pract Suppl*. 2000;113:46–53.
42. Alonso J, Ferrer M, Gandek B, et al.. Health-related quality of life associated with chronic conditions in eight countries: results from the international quality of life assessment (IQOLA) project. *Qual Life Res*. 2004;2004 (13):283–298.
43. Harris MI. Health care and health status and outcomes for patients with type 2 diabetes. *Diabetes Care*. 2000;23:754–758.
44. Rubin RR, Peyrot M. Men and diabetes: psychosocial and behavioral issues. *Diabetes Spectrum*. 1998;11:81–87.
45. Peyrot M, Rubin RR. A new quality of life instrument for patients and families. *Paper presented at the psychosocial aspects of diabetes study group third scientific meeting*. Madrid April 4–6; 1998.
46. Peterson T, Lee P, Young B, et al.. Well-being and treatment satisfaction in older people with diabetes. *Diabetes Care*. 1998;21:930–935.
47. Klein BE, Klein R, Moss SE. Self-rated health and diabetes of long duration. The Wisconsin epidemiologic study of diabetic retinopathy. *Diabetes Care*. 1998;21:236–240.
48. Brown DW, Balluz LS, Giles WH, et al.. Diabetes mellitus and health-related quality of life among older adults. Findings from the behavioral risk factor surveillance system (BRFSS). *Diabetes Res Clin Pract*. 2004;65(2):105–115.
49. Redekop WK, Koopmanschap MA, Stolk RP, Rutten GE, Wolffenbuttel BH, Niessen LW. Health-related quality of life and treatment satisfaction in Dutch patients with type 2 diabetes. *Diabetes Care*. 2002;25:458–463.
50. Schunk M, Reitmeir P, Schipf S, et al.. Health-related quality of life in subjects with and without Type 2 diabetes: pooled analysis of five population-based surveys in Germany. *Diabet Med*. 2012;29:646–653.
51. Jacobson AM, de Groot M, Samson JA. The evaluation of two measures of quality of life in patients with type I and type II diabetes. *Diabetes Care*. 1994;17:267–274.
52. Papadopoulos AA, Kontodimpoulous N, Frydas A, et al.. Predictors of health-related quality of life in type II diabetic patients in Greece. *BMC Public Health*. 2007;7:186.
53. Hahl J, Hämäläinen H, Sintonen H, et al.. Health-related quality of life in type 1 diabetes without or with symptoms of long-term complications. *Qual Life Res*. 2002;11:427–436.
54. Ahola AJ, Saraheimo M, Forsblom C, et al.. Health-related quality of life in patients with type 1 diabetes-association with diabetic complications (the FinDiane study). *Nephrol Dial Transplant*. 2010;25:1903–1908.
55. Peyrot M, Rubin RR. Levels and risks of depression and anxiety symptomatology among diabetic adults. *Diabetes Care*. 1997;20:585–590.
56. Wredling R, Stalhammar J, Adamson U, Berne C, Larsson Y, Oestman J. Well-being and treatment satisfaction in adults with diabetes: a Swedish population-based study. *Qual Life Res*. 1995;4:515–522.
57. Al Hayek AA, Robert AA, Al Saeed A, et al.. Factors associated with health-related quality of life among Saudi patients with type 2 diabetes mellitus; a cross-sectional survey. *Diabetes Metab J*. 2014;38:220–229.
58. Wong CK, Lo YY, Wong WH, et al.. The association of body mass index with physical and mental aspects of health-related quality of life in Chinese patients with type 2 diabetes mellitus: results from a cross-sectional survey. *Health Qual Life Outcomes*. 2013;11:142.
59. Imayama I, Plotnikoff R, Courneya K, Johnson J. Determinants of quality of life in adults with type 1 and type 2 diabetes. *Health Qual Life Outcomes*. 2011;9:115.
60. Miettola J, Niskanen LK, Viinamaki H, Sintonen H, Kumpusalo E. Metabolic syndrome is associated with impaired health-related quality of life: Lapinlahti 2005 study. *Qual Life Res*. 2008;17:1055–1062.
61. Hlatky MA, Chung S-C, Escobedo J, et al.. The effect of obesity on quality of life in patients with diabetes and coronary artery disease. *Am Heart J*. 2010;159:292–300.
62. Rejeski WJ, Lang W, Neiberg RH, et al.. Correlates of health-related quality of life in overweight and obese adults with type 2 diabetes [ast]. *Obesity*. 2006;14:870–883.
63. Kushner RF, Foster GD. Obesity and quality of life. *Nutrition*. 2000;16:947–952.
64. McCollum M, Hansen LB, Ghushchyan V, Sullivan PW. Inconsistent health perceptions for US women and men with diabetes. *J Women's Health*. 2007;16:1421–1428.
65. Sundaram M, Kavookjian J, Patrick JH. Health-related quality of life and quality of life in type 2 diabetes: relationships in a cross-sectional study. *Patient: Patient-Centered Outcomes Res*. 2009;2:121–133.

66. Wong CKH, Fung CSC, Siu SC, et al.. The impact of work nature, lifestyle and obesity on health-related quality of life in Chinese professional drivers. *J Occup Environ Med*. 2012;54:989–994.
67. Crisp AH, McGuiness B. Jolly fat: relation between obesity and psychoneurosis in general population. *BMJ*. 1976;1:7–9.
68. NIH. The practical guide: identification, evaluation, and treatment of overweight and obesity in adults. Bethesda, MD: NIH; 2000.
69. Corica F, Corsonello A, Apolone G, et al.. Construct validity of the Short Form-36 Health Survey and its relationship with BMI in obese outpatients. *Obesity (Silver Spring)*. 2006;14(8):1429–1437.
70. Shim YT, Lee J, Toh MPHS, Tang WE, Ko Y. Health-related quality of life and glycaemic control in patients with Type 2 diabetes mellitus in Singapore. *Diabetic Med*. 2012;29:e241–e248.
71. Weinberger M, Kirkman MS, Samsa GP, et al.. The relationship between glycemic control and health related quality of life in patients with non-insulin-dependent diabetes mellitus. *Med Care*. 1994;32:1173–1181.
72. Prospective UK. Diabetes study group: quality of life in type 2 diabetic patients is affected by complications but not by intensive policies to improve blood glucose or blood pressure control (UKPDS 37). *Diabetes Care*. 1999;22:1125–1136.
73. Ang COM, Maudren Tan LS, Tai ES, et al.. Factors associated with psychological distress, behaviour impact and health-related quality of life among patients with type 2 diabetes mellitus. *J Diabetes Complicat*. 2015;29:378–383.
74. Anderson RM, Fitzgerald JT, Wisdom K, Davis WK, Hiss RG. A comparison of global versus disease-specific quality-of-life measures in patients with NIDDM. *Diabetes Care*. 1997;20:299–305.
75. Wuslin LR, Jacobson AM, Rand LI. Psychosocial aspects of diabetic retinopathy. *Diabetes Care*. 1987;10:367–373.
76. Vickrey BG, Hays RD, Rausch R, Sutherling WW, Engel Jr J, Brook RH. Quality of life of epilepsy surgery patients as compared with outpatients with hypertension, diabetes, heart disease, and/or depressive symptoms. *Epilepsia*. 1994;35:597–607.
77. Shiu AT, Thompson DR, Wong RY. Quality of life and its predictors among Hong Kong Chinese patients with diabetes. *J Clin Nurs*. 2008;17:125–132.
78. Hill-Briggs F, Gary TL, Hill MN, et al.. Health-related quality of life in urban African Americans with type 2 diabetes. *J Gen Internal Med*. 2002;17:412–419.
79. Zigmond AS, Smith RP. The hospital anxiety and depression scale. *Acta Psychiatrica Scand*. 1983;67:361–370.
80. Savas S, Köroğlu BK, Koyuncuoğlu HR, Uzar E, Celik H, Tamer NM. The effects of the diabetes related soft tissue hand lesions and the reduced hand strength on functional disability of hand in type 2 diabetic patients. *Diabetes Res Clin Pract*. 2007;77(1):77–83.
81. Wändell PerE. Quality of life of patients with diabetes mellitus an overview of research in primary health care in the Nordic countries. *Scand J Prim Health Care*. 2005;23(2):68–74.
82. Nglazi MD, West SJ, Dave JA, Levitt NS, Lambert EV. Quality of life in individuals living with HIV/AIDS attending a public sector antiretroviral service in Cape Town, South Africa. *BMC Publ. Health*. 2014;14:676.
83. Kennedy NA, Faye KI, Chukwuemeka SP. Psychiatric comorbidity and quality of life in persons with diabetes mellitus and people living with HIV (PLWHIV) in Port Harcourt, Nigeria. *Am J Psychiat Neurosci*. 2015;3(6):154–164.
84. United Nations Joint Program on HIV and/or AIDS. The gap report. Geneva. <http://www.unaids.org/sites/default/files/media_asset/UNAIDS_Gap_report_en.pdf>; 2014. Last accessed on 28th February 2017.
85. Airoldi M, Zaccarelli M, Bisi L, et al.. One-pill once-a-day HAART: a simplification strategy that improves adherence and quality of life of HIV-infected subjects. *Patient Prefer Adherence*. 2010;4:115–125.