

Original Research Article

Awareness of Chronic Complications of Diabetes Mellitus among Patients at St Charles Boromeo Specialist Hospital, Onitsha in South Eastern Nigeria

Chidiebele M. Ezeude^{1*}, Arinze A. Onwuegbuna², Afoma M. Ezeude³, Akunne I. Apakama², Ejike E. Igboegwu⁴, Ugochukwu A. Eze⁵, Henry E. Ikeabbah⁶, Harriet C. Nwadinmka⁷

¹Department of Internal Medicine, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria

²Department of Ophthalmology, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria

³Department of Nursing Sciences, Nnamdi Azikiwe Teaching Hospital, Nnewi, Anambra State, Nigeria

⁴Department of Ophthalmology, Federal Medical Center, Onitsha, Anambra State, Nigeria

⁵Department of Ophthalmology, Federal Medical Center, Asaba, Delta State, Nigeria

⁶Department of Surgery, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria

⁷Department of Internal Medicine, Nnamdi Azikiwe University Teaching Hospital, Nnewi, Anambra State, Nigeria

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Abstract: *Introduction:* Diabetes mellitus (DM) is a chronic multisystemic disorders that causes complications that include long-term damage, dysfunction and failure of various organs in the body. *Objective:* The study aimed at determining the awareness of the chronic complication of DM that included ocular disorders, stroke, heart attack/heart failure, foot ulcer, skin rashes, sexual organs dysfunction and pregnancy losses by the subjects with DM at Onitsha, South Eastern Nigeria. *Materials and Methods:* This was a cross-sectional, descriptive hospital-based study involving 128 consenting DM subjects at St Charles Boromeo Specialist Hospital, Onitsha. The study-subjects were recruited using a convenient sampling method. Data collection was done with a pre-tested researcher-structured questionnaire. Laboratory tests that included fasting plasma glucose and glycated haemoglobin were done. Also, blood pressure and anthropometric measurements were done. Data was analysed using SPSS version 25. The mean values and the standard deviation of the continuous variables were calculated. Categorical variables were presented in tables as frequencies and percentages and compared using Chi-Square test. The level of significance was set at $p < 0.05$. *Result:* A total of 128 DM subjects were studied comprising 98.4% type 2 DM subjects and 1.6% subjects with gestational DM respectively. The mean age of the subjects was 59.41 ± 12.32 years. 40.6% and 59.4% of the subjects were male and female subjects respectively. The most commonly known chronic complications of DM among the subjects were poor vision/blindness (87.5%), foot ulcer (75.0%), stroke (55.5%), renal failure (38.3%), heart attack/heart failure (35.9%) and skin rashes (26.6%) respectively. The least commonly known complications were sexual organ dysfunction (16.4%) and miscarriage/pregnancy loss (8.6%) respectively. The sources of information on the chronic complications of DM among the subjects included, friends/family members (37.5%), healthcare professionals (21.9%), internet (5.5%), mass media (3.9%), social media (3.1%) and personal experience & others (17.2%). Lastly, there was no significant association between the awareness of the chronic complications of DM and the socio-clinical factors evaluated among the subjects ($p < 0.05$ in all the cases). *Conclusion:* The level of awareness that DM could cause chronic complications generally, was above average, but that of the specific organ systems affected was largely suboptimal. Equally, healthcare professionals contributed minimally towards educating the subjects about the complications of diabetes and finally, no significant association was found between the awareness of the chronic complications of DM and the socio-clinical factors evaluated.

Keywords: Awareness, diabetes mellitus, chronic complications, Charles Boromeo, Nigeria, patients.

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INTRODUCTION

Diabetes mellitus is defined as a metabolic disorder of multiple aetiology characterized by chronic hyperglycaemia with disturbances of carbohydrate, protein and fat metabolism resulting from defects in insulin secretion, insulin action or both [1]. The effects of diabetes mellitus include long-term damage, dysfunction and failure of various organs. Diabetes is aetiologically classified into type 1, type 2, gestational DM and others [1].

Diabetes mellitus is approaching a pandemic level globally. According to the International Diabetes Federation (IDF), an estimated 366 million people had DM globally with an estimated prevalence of 8.3% as of 2011 [2]. This figure is projected to hit 552 million by the year 2030, giving a prevalence rate of 9.9% [2].

The reported prevalence rate of DM in Nigeria was 3.3% out of which 48% were unaware of their status [3].

Diabetes mellitus is a multi-systemic disorder and its chronic complications likewise affect multiple body systems. Most of the debilitations of diabetes result from its chronic complications which include: retinopathy, diabetic foot, renal complications, stroke, heart complications, neuropathy, hypertension and sexual organ dysfunction [4]. Long term diabetes complications evaluated by this study included ocular diseases, stroke, heart attack and heart failure, foot ulcers, skin rashes, sexual organ dysfunction (erectile and female sexual dysfunction) and pregnancy losses. The geometric increase in the prevalence of diabetes and its complications places a heavy burden on the patients and the healthcare system [5]. Most complications of diabetes are largely preventable through increasing awareness [6]. Creating awareness about diabetes, its management and complications would go a long way towards the prevention, early identification of and management of the diabetic complications [7]. Additionally, awareness of the nature and complications of diabetes would improve adherence to diabetic treatment and prompt treatment of diabetes related complications. This includes adopting and adhering to the necessary life style modifications and other preventive measures, as well as early identification and treatment of the complications [8].

Bodunde *et al.*, in Western Nigeria found that of the 148 diabetes subjects they studied, about 41%, 54%, 77.7%, 39.2%, 66.2%, 40.5% and 41.9% were aware that diabetes mellitus could affect the brain, kidneys, eyes, blood vessels, legs, skin and genitals respectively [9]. In Bauchi, Northern Nigeria Sabo *et al.*, found out that 75.3% of the 77 out-patients studied were aware that DM causes kidney damage, 79.2%, 81.8% and 63.6% were aware it causes peripheral neuropathy, poor wound healing and poor blood circulation (cardiovascular diseases) respectively [10]. 44.4% of

these respondents had good knowledge about prevention of these long-term complications of DM while 59.7% had good knowledge about the benefits of blood sugar control [10]. In Northwest Ethiopia, Kifle *et al.*, found that 58.8% of the diabetes subjects they studied had adequate knowledge of the chronic complications of diabetes mellitus [11]. In Saudi Arabia, Fatani *et al.*, found that 72.9%, 71.2%, 56.2%, 53.8%, 42.5%, 40.1%, 33.1%, 20.4% and 18.7% of the 299 DM subjects they studied recognised that eye disease, diabetic foot ulcer, renal disease, neuropathy, sexual impairment, heart disease, high blood pressure, sudden death and cerebrovascular disease were complications of DM respectively [8]. In Owerri, Eastern, Nigeria, Achigbu *et al.*, found that 40.77% of 103 DM subjects they studied knew that ocular complications were associated with diabetes [12].

There is a dearth of published data assessing the awareness of the chronic complications of DM by persons living with diabetes in Nigeria, especially in the Southeast. The study aimed at assessing the perceived awareness of the long-term complications of diabetes among the out-patients diabetes subjects of a major specialist mission hospital in South Eastern Nigeria.

Awareness of the complications is important to prevent diabetes related morbidity and mortality [13]. This study aimed at assessing awareness of the chronic complications of diabetes among the out-patient diabetic subjects at St Charles Boromeo Specialist Hospital, Onitsha in South Eastern Nigeria.

MATERIALS AND METHODS

This was a cross sectional, descriptive hospital-based study involving 128 consenting diabetic subjects seen consecutively at the out-patient diabetes clinic at St Charles Boromeo Specialist Hospital, Onitsha, in South Eastern Nigeria. St Charles Boromeo Specialist Hospital is a popular mission health care centre in the eastern part of Nigeria, owned by the catholic dioceses of Onitsha and has been operational since 16th December, 1964. It provides primary, secondary and tertiary (specialized) health care services to people from Anambra and the other surrounding states of Delta, Imo, Abia, Rivers and Enugu states. Onitsha is a metropolitan inland river port city which lies along the eastern bank of the river Niger on its course to the delta tributaries into the Atlantic Ocean. It is a major commercial city in Nigeria, a historic town that is also home to notable health care and educational facilities.

A convenient sampling method was used for recruiting the study-subjects as all consenting patients with DM that were seen consecutively at diabetes clinic and who met the inclusion criteria were recruited for the study. Subjects were excluded from the study if they withheld consent, were less than 18 years of age or were very sick.

Data collection was done with a pre-tested researcher structured questionnaire, while blood sample collection was done via venipuncture of the cubital vein following aseptic procedure. The researcher had two meetings with the subjects on two separate clinic days.

At the first meeting, informed consent was gotten, anthropometric and blood pressure measurements were done. At the second meeting 3ml of blood was collected from each subject via a venipuncture of the cubital vein after an overnight fast, while observing full aseptic procedures. 2ml of blood was stored at -20⁰c in fluoride oxalate bottle and used for fasting blood sugar (FBS) assay while 1 ml was stored in ethylenediaminetetraacetic acid (EDTA) bottle and used for glycated haemoglobin (HbA1c) assay. Plasma glucose assay was done by the Trinder glucose oxidase method while HbA_{1c} was measured using the boronate affinity chromatography method [14, 15]. Weight and height were measured using Stadiometer (RGZ-120), waist circumference measured with a measuring tape and blood pressure measured using Accoson mercury sphygmomanometer.

Data Analysis

Data collected was entered into spreadsheet using Microsoft Office Excel, and then analyzed using Statistical Package for Social Sciences (SPSS) version 25. Result of categorical variables were presented in tables as frequencies and percentages. The mean values and standard deviation for the continuous variables were calculated. Chi-square test or Fisher’s Exact test was used to compare categorical variables. Logistic regression analysis was performed to estimate odds ratios and 95% confidence interval for factors associated with development of ocular complication of diabetes. The level of significance for all test was set at $p < 0.05$.

Definition of Terms and Criteria

1. Hypertension was defined as systolic BP ≥ 140 mmHg and or diastolic BP ≥ 90 mmHg measured on at least 2 separate occasions or if patient was already on anti-hypertensive medications [16].
2. Poor glycaemic control was taken as HbA_{1c} $\geq 7.0\%$ [1].
3. Global obesity was defined by body mass index (BMI) >30 (kg/M²) [1].

4. Central obesity was defined by waist to hip ratio (WHR) > 0.9 [1].
5. Diabetes mellitus was defined by fasting plasma glucose of ≥ 7.0 mmol/l (126 mg/dl) that was measured on at least 2 separate occasions or patient was already on glucose lowering agents [1].
6. Type 1 DM was defined as subjects with DM requiring insulin and diet therapy for blood glucose control and diagnosed when they were less than 30 years [1].
7. Type 2 DM was defined as patients with DM on diet therapy either alone or in combination with oral glucose lowering agent(s) for glycaemic control [1].
8. Gestational diabetes mellitus (GDM) was defined as carbohydrate intolerance resulting in hyperglycaemia of variable severity with onset or first recognition during pregnancy [1].
9. Young age was taken as 18-44 years, middle age as 45-64 years and old age as 65 years and above [17].

RESULTS

A total of 128 diabetic subjects had complete results and were analyzed. They were made up of 126 (98.4%) subjects with T2DM and 2 (1.6%) subjects with GDM. Also 52 (40.6%) were male subjects while 76 (59.4%) were female subjects with a ratio of 1: 1.46.

Socio Demographic Characteristics of the Study-Subjects

The age bracket of the subjects varied from 18 to 86 years with the mean determined as 59.41 ± 12.32 years. Most of the subjects were in the middle (58.6%) and old age (32.0%) categories. There were more female subjects (59.4%) than male subjects (40.6%). About 40% of them had tertiary (35.9%) and postgraduate (3.9%) education, 28.1% had secondary and primary education respectively while 3.9% had no formal education. With respect to occupation, 41.4% were into business, 29.7% were retired, while 17.2% were civil servants; 6.3%, 3.9% and 1.6% were clergy, artisans and farmers respectively. Only 9.4% of the subjects were single; 85.9% were married and 4.7% were widowed (details in Table 1).

Table 1: Socio demographic characteristics of the study-subjects

Variable	Frequency	Percentage (%)
Age		
Young age	12	9.4
Middle age	75	58.6
Old age	41	32.0
Mean = 59.41 ± 12.32 years		
Gender		
Male	52	40.6
Female	76	59.4

Variable	Frequency	Percentage (%)
Educational level		
Non formal	5	3.9
Primary	36	28.1
Secondary	36	28.1
Tertiary	46	35.9
Postgraduate	5	3.9
Occupation		
Business	53	41.4
Civil servant	22	17.2
Clergy	8	6.3
Farmer	2	1.6
Retired	38	29.7
Artisan	5	3.9
Marital status		
Single	12	9.4
Married	110	85.9
Widowed	6	4.7

Clinical Characteristics of the Study-Subjects

The mean values of the clinical parameters assessed are as follows; body mass index (BMI) ($29.99 \pm 5.65 \text{ kg/m}^2$), waist circumference (WC) ($99.84 \pm 14.3 \text{ cm}$), waist to hip ratio (W/H) (1.01 ± 0.10), systolic blood pressure (SBP) ($130.31 \pm 18.67 \text{ mmHg}$), diastolic blood pressure (DBP) ($78.67 \pm 11.32 \text{ mmHg}$), fasting blood glucose (FBG) ($9.25 \pm 4.26 \text{ mmol/L}$), Glycated haemoglobin (HbA1c) ($8.80 \pm 2.88 \%$), duration of diabetes ($9.80 \pm 8.14 \text{ years}$).

Result showed that 30 (23.4%) had hypertension; 36 (28.1%) had a good glycemic control; 81 (63.3%) had central obesity, while 59 (46.1%) had global obesity. Almost all the subjects 126 (98.4%) had type 2 DM; 2 (1.6%) had GDM while none had T1DM. Also 89 (69.5%) had long duration of diabetes, while 39 (30.5%) had short duration. Majority of the subjects; 88 (69.5%) were on one (1) oral anti-diabetic drug for treatment for diabetes; 27 (21.1%) were on a combination of OAD + Insulin, while only 2 (1.6%) were on insulin only (details in Table 2).

Table 2: Clinical characteristics of the study-subjects

Parameter	Mean/Frequency	SD/%
Body mass index (kg/m^2)	29.99	5.65
Waist circumference (cm)	99.84	14.31
Waist to hip ratio	1.01	0.10
Systolic blood pressure (mm Hg)	130.31	18.67
Diastolic blood pressure (mm Hg)	78.67	11.32
Fasting blood glucose (mmol/L)	9.25	4.26
HbA1c (%)	8.80	2.88
Duration of Diabetes (years)	9.80	8.14
Hypertension		
Present	30	23.4
Absent	98	76.6
Glycemic control		
Good	36	28.1
Poor	92	71.9
Central obesity		
Present	81	63.3
Absent	47	36.7
Global obesity		
Present	59	46.1
Absent	69	53.9
Type of Diabetes Mellitus		
Type 1	0	0
Type 2	126	98.4
GDM	2	1.6
Diabetes duration		
Short	39	30.5
Long	89	69.5

Parameter	Mean/Frequency	SD/%
Treatment for Diabetes		
1 oral antidiabetic drug (OAD)	88	68.8
2 or more OADs	11	8.6
Insulin only	2	1.6
OAD + Insulin	27	21.1

HbA1c = Glycated haemoglobin; DM = Diabetes mellitus; GDM = Gestational diabetes mellitus; OAD(s) = Oral antidiabetic drug(s)

Awareness of Chronic Complications of DM among the Subjects

The result showed that the awareness that DM could cause chronic complications among the subjects was 64.1%. Regarding the awareness of the individual systemic complications, the most commonly known ones were poor vision/blindness (87.5%) and foot ulcer (75.0%), followed by stroke (55.5%), renal failure (38.3%), heart attack/heart failure (35.9%) and skin

rashes (26.6%) respectively. The least commonly known systemic complication of diabetes were sexual organ dysfunction (16.4%) and miscarriage/pregnancy loss (8.6%) respectively. The sources of information on the systemic complications of diabetes included friends/family members (37.5%) and healthcare professionals (21.9%), internet (5.5%), mass media (3.9%), social media (3.1%) and personal experience & others (17.2%) (details in Table 3).

Table 3: Awareness of chronic complications of DM among the subjects

Variable	Frequency	Percentage (%)
Awareness of chronic complications of DM		
Yes	82	64.1
No	46	35.9
Awareness of systemic complications		
Poor vision/blindness	112	87.5
Stroke	71	55.5
Heart attack/heart failure	46	35.9
Renal failure	49	38.3
Foot ulcer	96	75.0
Skin rashes	34	26.6
Miscarriage/pregnancy loss	11	8.6
Sexual organ dysfunction	21	16.4
Source of information on systemic complications		
Healthcare professional	28	21.9
Internet	7	5.5
Mass media	5	3.9
Social media	4	3.1
Friends/family members	48	37.5
Personal experience & others	22	17.2

Factors Associated with Awareness of Chronic Complications of Diabetes Mellitus among the Subjects

Result showed that the factors assessed showed no statistically significant association with awareness of

systemic complications of diabetes mellitus ($p > 0.05$ in all cases). Logistic regression analysis was therefore not performed here.

Table 4: Factors associated with awareness of chronic complications of diabetes mellitus among the subjects

Factor	Awareness of systemic complication n (%)		X ²	p-value
	Yes	No		
Hypertension				
Present	19 (63.3)	11 (36.7)	0.009	0.924
Absent	63 (64.3)	35 (35.7)		
Glycemic control				
Good	25 (69.4)	11 (30.6)	0.630	0.427
Poor	57 (62.0)	35 (38.0)		
Central obesity				
Present	52 (64.2)	29 (35.8)	0.002	0.967
Absent	30 (63.8)	17 (36.2)		

Factor	Awareness of systemic complication n (%)		X ²	p-value
	Yes	No		
Global obesity				
Present	38 (64.4)	21 (35.6)	0.006	0.940
Absent	44 (63.8)	26 (36.2)		
Type of DM				
Type 1	0	0	3.622	0.057
Type 2	82 (65.1)	44 (34.9)		
GDM	0	2 (100)		
Duration of Diabetes				
Short	24 (61.5)	15 (38.5)	0.155	0.694
Long	58 (65.2)	31 (34.8)		
Treatment for Diabetes				
1 oral antidiabetic drug (OAD)	52 (59.1)	36 (40.9)	3.601	0.308
2 or more OADs	8 (72.7)	3 (27.3)		
Insulin only	2 (100)	0		
OADs + Insulin	20 (74.1)	7 (25.9)		
Age				
Young age	6 (50.0)	6 (50.0)	1.140	0.565
Middle age	49 (65.3)	26 (34.7)		
Old age	27 (65.9)	14 (34.1)		
Gender				
Male	32 (61.5)	20 (38.5)	0.242	0.623
Female	50 (65.8)	26 (34.2)		
Educational level				
Non formal	4 (80.0)	1 (20.0)	1.233	0.873
Primary	21 (58.3)	15 (41.7)		
Secondary	24 (66.7)	12 (33.3)		
Tertiary	30 (65.2)	16 (34.8)		
Postgraduate	3 (60.0)	2 (40.0)		
Occupation				
Business	33 (62.3)	20 (37.7)	1.777	0.879
Civil servant	14 (63.6)	8 (36.4)		
Clergy	4 (50.0)	4 (50.0)		
Farmer	1 (50.0)	1 (50.0)		
Retired	27 (71.1)	11 (28.9)		
Artisan	3 (60.0)	2 (40.0)		
Marital status				
Single	8 (66.7)	4 (33.3)	1.088	0.580
Married	69 (62.7)	41 (37.3)		
Widowed	5 (83.3)	1 (16.7)		

DM = Diabetes mellitus; GDM = Gestational diabetes mellitus; OAD(s) = Oral antidiabetic drug(s)

DISCUSSION

A total of 128 diabetic subjects were studied, this was made up of 98.4% and 1.6% of T2DM and GDM subjects respectively. Also 40.6% of the subjects were male subjects, while 59.4% were female subjects.

Awareness of Chronic Complications of Diabetes Mellitus among the Subjects

Chronic complications of DM are every prevalent among DM subjects and sometimes are even present at the time of diagnosis. The awareness of DM and its complications needs to be enhanced in both the developed and the developing nations and this would be achieved through educational interventions and easy accessibility to diabetes services [18]. The level of education of the DM subjects and the general population

appears to greatly influence the perceived knowledge of diabetic complications [19].

This study found that 64.1% of the DM subjects studied were aware that DM has chronic complications. Of these, 87.5% were aware that DM causes ocular disorders, 75.0% knew that it causes foot ulcer, while 55.5%, 38.3%, 35.9%, 26.6%, 16.4% and 8.4% of the DM respondents were aware that it causes stroke, renal failure, heart attack, skin rashes, sexual organ dysfunction and pregnancy losses respectively.

In Ondo, western Nigeria, a study found that among 105 T2DM subjects, 84.8% knew that DM could cause retinopathy, 79.0% knew that it could affect the feet (neuropathy), while 61.9% knew it could cause

cardiac disorders [20]. Equally, 61.9% of the subjects was aware that DM could cause cerebral damage (stroke), while 63.8% and 60% of the subjects were aware that DM could cause erectile dysfunction and nephropathy respectively [20]. In comparison with the index study, the study done in western Nigeria found similar prevalence of the awareness of the ocular and neuropathic complications of DM among their subjects 84.8% vs 87.5% and 79.0% vs 75.0% respectively). Expectedly, both studies were done in Nigeria and had similar sample size. The mean age and sex distribution of the study-participants in both studies are equally similar: 59.41 ± 12.32 years vs 56 ± 9.9 years and 1:1.46 vs 1:1.5 by the index study and Adeyemi *et al.*, respectively. On the other hand, there is disparity in the mean duration of DM from the two studies: 9.8 ± 8.14 years vs 6.7 ± 7.1 years by the index study and Adeyemi *et al.*, respectively. Distinctively also, the subjects studied by Adeyemi *et al.*, demonstrated better awareness regarding DM as the cause of chronic complications that included: cardiac abnormalities (61.9%), stroke (61.9%) and erectile dysfunction (63.8%), compared to this study that reported 35.9%, 55.5% and 16.4% respectively [20].

Amoo *et al.*, in a survey in the general population in Nigeria found that the knowledge of the complications of DM was significantly more among the educated compared to the uneducated [21]. Also, a multicentre study among the general population done in the eastern and northern Nigeria found that 63.9% of the general population had a good knowledge of diabetes [22]. Obirikorang *et al.*, found in Ghana that 60.0% of T2DM patients did not have knowledge about DM complications [23]. Unlike in the index study, only 17.7% of their respondents knew that DM causes eye diseases, 51.5% knew that it causes foot ulcers, while 29.2%, 9.2%, 5.4% and 35.4% knew that it causes neuropathy, heart diseases, renal diseases and hypertension respectively [23]. Another study in Ghana found that majority of the diabetic subjects (54.1%) had inadequate knowledge while 45.9% had adequate knowledge of diabetic complications [24]. The awareness of DM complications among diabetic subjects was apparently lower in Ghana compared to the finding of this study and that of Adeyemi *et al.*, both in Nigeria. This difference could be due to the educational levels of the population studied in the different settings.

Gizaw *et al.*, in Ethiopia found that majority (41.0%) of their DM subjects did not have the knowledge of DM complications, 39.0% had inadequate knowledge, while 20.0% had adequate knowledge [25]. 40.3% of the respondents were aware that DM causes poor wound healing, 36.4% knew that it causes eye disorders, while 35.4% were aware that it causes hypertension and renal diseases [25]. Equally, Belsti *et al.*, in Ethiopia found that only 48.5% of the DM subjects were aware of DM complications [13]. Still the level of knowledge of DM

complications among DM subjects appear poorer in these studies compared to the finding of this study.

In Nepal, Agrawaal *et al.*, found that 51.0% of DM subjects were aware that DM causes delayed wound healing, 36.0% were aware that it causes cardiac complications, 27.0%, 36.0% and 18.0% knew that it causes eye disorders, neuropathy and cerebrovascular accident (stroke) respectively [7]. In India, the awareness of the complications of DM was high among DM subjects and is comparable to the finding of the index study: Gulabani *et al.*, was aware that 90.1% of their DM cohorts were aware that DM could damage the eyes, 64.4% knew that it could damage the heart, while 72.3%, 57.4%, 33.7% and 7.9% knew it could damage the kidneys, feet, bones and spine respectively [26].

Fatani *et al.*, in Saudi Arabia found that the knowledge of the complications of DM among diabetic clients was 72.9% for eye diseases, 71.2% for diabetic foot ulcers and 56.2% and 53.8% for renal diseases and neuropathy respectively [8]. Furthermore, 42.5% knew that DM causes sexual impairment, 40.1% were aware that it causes heart disease while 33.1%, 20.4% and 18.7% knew that it causes high blood pressure, sudden death and stroke respectively [8]. These findings are similar to those of the index study and some of the reasons for this may be related to the similarity in the methodology adopted for the two groups of researchers. There is similarity in the gender distribution as well as the duration of diabetes of the two different study-populations: Fatani *et al.*, had a male/female ratio of 1:1.56 compared to 1:1.46 by this study [8]. Also, the population studied by both groups of researchers had long duration of diabetes: 63.2% of the subjects studied by Fatani *et al.*, had DM duration > 5 years while the average duration of DM was 9.80 ± 8.14 years in this study [8]. Paneru *et al.*, found that 95% of their diabetic clients knew that DM increased the risk of visual loss while only 13% knew it could cause nerve damage [27]. Waris *et al.*, in Pakistan recorded a high knowledge score of 85.5% of DM complications among their T2DM subjects [28]. Diallo *et al.*, in Senegal, found that the knowledge of diabetes was associated with higher level of education while the awareness of diabetes was associated with being a healthcare staff and having a family history of diabetes mellitus [29].

The Sources of Information on the Chronic Complications of Diabetes among the Subjects

The sources of information regarding the systemic complications of DM reported by the respondents in this study included; friends and family members (37.5%), health care professionals (21.9%), internet (5.5%), mass media (3.9%), social media (3.1%), personal experience and others (17.2%). Fatani *et al.*, reported that 80.0% of their subjects knew that uncontrolled DM causes long term complications and the sources were: 23.7% from diabetologists, 10.7% from other doctors, 20% from relatives, 18.7% from social

media, 6.3% from books and papers, 3.6% from volunteer campaigns and 17.0% from other sources [8]. Mersha *et al.*, found that physicians and eye doctors (ophthalmologists) were the most frequent sources of information regarding the awareness of diabetic retinopathy, while Nathaniel *et al.*, found that the awareness that diabetes affected the eye among their DM subjects came from health care personnel, mass media, internet, print media and from other sources in 79.2%, 16.1%, 9.0%, 8.2% and 5.7% respectively [30, 31]. Apparently, clinicians don't educate their diabetic clients enough and well about DM and its attendant consequences more especially in the sub-Saharan Africa and this may have to do with the limited number of available clinicians orchestrated by the trending brain drain of the health care personnel for greener pastures, which consequently limit the time for consultation and doctor - patient interactions during consultations. Balogun *et al.*, found that the doctor - patient ratio in Nigeria stood at an alarming 1:9083 far from the recommended 1:600 ratio while Obubu *et al.*, found the health personnel - patient ratio of 1:2942, 1:2165 and 1:511 for the general medical doctor, specialist doctor and nurse respectively [32, 33].

Factors Associated with Awareness of Chronic Complications of Diabetes among the Subjects

This study did not find any statistically significant association between the awareness of the systemic chronic complications of the DM and the variables tested that included: the type of DM, duration and treatment modality for DM, glycaemic control, age of the subjects, hypertension, obesity (central and global), educational level, occupation and marital status. Contrastingly, Afaya *et al.*, found that female gender, older age, primary education, no formal education, rural dwelling and not having family history of DM were significantly associated with the level of awareness of the chronic complications of DM among their T2DM subjects [24]. Similarly, Obirikorang *et al.*, found that female gender, married participants, widowed participants, basic level of education, educational level of junior high school and above, longer duration of DM and urban dwelling were the risk factors associated with the level of diabetic complications [23]. Equally, Belsti *et al.*, found that male sex, increasing age, increasing educational and better income status and having a family history of DM were significantly associated with good awareness of the chronic complications of diabetes mellitus [13]. Also, Gizaw *et al.*, found a significant association between the knowledge of the chronic complications of DM and the risk factors of DM that included increasing age, male gender, high income earning, higher educational level and urban residency [25].

Kifle *et al.*, found that the knowledge of the chronic complications of DM was significantly associated with age between 26 – 45 years, ability to read and write, duration of diabetes diagnosis greater than 10

years and the occupational status of being a daily labourer while Rahaman *et al.*, found that educational level was the most important significant predictor of the knowledge of chronic complications of diabetes mellitus [11, 34]. Fatema *et al.*, found that diabetic subjects of urban residency, higher educational background and upper socio-economic class demonstrated significantly greater score in the knowledge of diabetes and that also male subjects showed better knowledge of DM compared with their female counterparts [35].

Finally, Anyanti *et al.*, found that the knowledge of DM was significantly associated with physical activities and the level of education among the general population [22].

CONCLUSION

The level of awareness that DM could cause chronic complications found by this study was above average, but that of the specific organ systems affected was highly suboptimal. Also, our health care personnel did not educate the DM subjects enough regarding the complication of DM, making them resort to their friends, family members and some other unprofessional sources for this information.

Conflict of Interest: None declared.

Ethical Approval

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Author's Contributions:

CME- conception, design of research and manuscript writing

AAO – literature search

AME – design, critical review and editing

AIA– data collection and interpretation

E EI – design of research and manuscript writing

UAE – manuscript editing and critical review

HEI – literature search and editing of manuscript

HCN – manuscript writing and editing

The authors read and approved the final manuscript

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