Original Research

The Science of Diabetes Self-Management and Care
2025, Vol. 51(2) 141–155

DOI: 10.1177/26350106251323611
journals.sagepub.com/home/tde

Diabetes Knowledge and Self-Care Practices Among Patients With Type 2 Diabetes Mellitus in Uvira, Kiliba, Sange, and Luvungi, South Kivu Province of the Democratic Republic of Congo

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Abstract

Purpose: The purpose of this study was to assess baseline knowledge and self-care practices about diabetes mellitus (DM) among patients with type 2 diabetes mellitus (T2DM) in Uvira, Kiliba, Sange, and Luvungi (U-KI-SA-LU), South Kivu Province of the Democratic Republic of Congo (DRC).

Methods: A community-based cross-sectional study was conducted among 328 T2DM patients (179 men and 149 women) in U-KI-SA-LU, South Kivu Province of DRC from February 1 to April 30, 2024. Data were collected using pretested questionnaires and were analyzed using descriptive statistics and *F* statistic for the analysis of variance test with value of $P < .05$ as the level of statistical significance.

Results: Of the 328 participants, 188 (57.4%) had good general knowledge about DM; only 149 (45.4%) had good self-care practices about DM. Being married, having higher education, and being on insulin injection were associated with good knowledge; only being married was associated with good self-care practices toward DM. Surprisingly, 167 (50.9%) of the participants never had an eye examination, only 51 (15.5%) ate fruits for 3 or more days over the past 7 days, and 77 (23.5%) had access to a personal glucometer.

Conclusions: Structured educational programs are needed to improve DM knowledge and self-care practices in order to slow down the progression of DM and prevent complications. These results also suggest raising awareness about health care professionals' role in DM management through not only continuing education programs but also traditional media, including print advertising, television, radio, and newspapers.

Résumé

Objectif: L'objectif de cette étude était d'évaluer les connaissances de base et pratiques d'autosoins concernant le diabète parmi les malades atteints du diabète de type 2 à Uvira, Kiliba, Sange et Luvungi (U-KI-SA-LU), province du Sud-Kivu de la République Démocratique du Congo (RDC).

Matériel et méthodes: Une étude transversale communautaire a été menée parmi 328 (179 hommes et 149 femmes) malades atteints du diabète de type 2 à U-KI-SA-LU, province du Sud-Kivu en RDC du 1er février au 30 avril 2024. Les données ont été collectées à l'aide de questionnaires pré-testés et ont été analysées à l'aide de statistiques descriptives et de la statistique F pour le test ANOVA avec la valeur de $P < .05$ comme le niveau de signification statistique.

Résultats: Sur les 328 malades, 188 (57,4%) avaient de bonnes connaissances générales sur le diabète, alors que seulement 149 (45,4 %) avaient de bonnes pratiques d'autosoins concernant le diabète. Les malades soit

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mariés, soit avec un niveau d'éducation plus élevé, soit sous injection d'insuline étaient associés à de bonnes connaissances alors que seuls les malades mariés étaient associés à de bonnes pratiques d'autosoins concernant le diabète. Étonnamment, 167 (50,9%) malades n'ont jamais subi d'examen de la vue et, seulement 51 (15,5%) ont mangé des fruits pendant 3 jours ou plus au cours des 7 derniers jours et 77 (23,5%) avaient accès à un glucomètre personnel.
Conclusion: Des programmes éducatifs structurés sont nécessaires pour améliorer les connaissances sur le diabète et pratiques d'autosoins afin de ralentir la progression du diabète et prévenir les complications. Ces résultats suggèrent également de sensibiliser les professionnels de la santé sur leur rôle dans la gestion du diabète non seulement par le biais de programmes de formation continue, mais également par les médias traditionnels, notamment la publicité imprimée, la télévision, la radio et les journaux.

Diabetes mellitus (DM), the fastest growing global public health threat, is progressively spreading to every corner of the world, making it a global pandemic. In 2021, it was estimated that 537 million people worldwide were living with DM, and this number is projected to reach 643 million by 2030 and 783 million by 2045.[1,2] Type 2 diabetes mellitus (T2DM) has had the alarming jump in ranks as the leading cause of deaths from 19th position in 1990 to 9th position in 2017.[3] Some fragmentary studies have reported that in the Democratic Republic of Congo (DRC), the prevalence of DM varies between 3.5 and 14%, and the DRC will experience, like other Sub-Saharan African (SSA) countries, an exponential increase in cases of T2DM in the coming years[4-6] if appropriate preventive measures are not undertaken. Increased prevalence of T2DM in the DRC is attributed to the lifestyle transition coupled with modifiable risk factors, such as urbanization, obesity, high-energy Western-style diet, and lack of physical activity.[7]

Low awareness and poor self-care practices among patients with T2DM are some of the important variables influencing the progression of DM and its complications in the DRC. The level of patients' knowledge and awareness of DM is crucial to health educators to plan for future DM self-management education programs in order to help patients play an important role in the self-management of their disease.[8] Patients with T2DM with good disease knowledge have a better understanding of the nature and consequences of the disease and are more likely to participate in the prevention of either microvascular (nephropathy, neuropathy, and retinopathy) or macrovascular (cardiovascular disease, peripheral artery disease, and stroke) complications.[8] Similarly, there is strong evidence that patients with good knowledge about DM and its complications would seek proper treatment and care and follow the recommended self-care practices that would enable the maintenance of optimal glycemic control through lifestyle modification, including regular exercise, healthy diet and weight loss, monitoring of blood glucose levels, and medication adherence.[9,10] Even though the DRC is among the 5 SSA countries with a large number of people living with DM[11] and having good knowledge and self-care practices regarding DM are considered the key strategy for preventing, managing, and controlling DM,[12] there is a paucity of evidence of current knowledge and self-care practices related to DM among patients with T2DM in Uvira, Kiliba, Sange, and Luvungi (U-KI-SA-LU), South Kivu Province of DRC. Identification of the level of knowledge and self-care practices among patients living with T2DM would provide better insight for the development of effective programs and techniques for DM self-management education and support, which is a key strategy for preventing, managing, and controlling DM. Therefore, the aim of this study was to assess baseline knowledge and self-care practices related to DM among patients with T2DM in U-KI-SA-LU, South Kivu Province of DRC.

Social-Ecological Approach to Diabetes

The prevalence of DM has been rising more rapidly in low- and middle-income countries (LMICs),[13] which account for nearly 80% of the world's population with diabetes.[14] There is consistent evidence for excess rates of T2DM in the DRC; however, there is less evidence concerning which factors are most linked to this increase in the prevalence of T2DM in U-KI-SA-LU, South Kivu Province of DRC—such understanding, using a socio-ecological approach, is critical to the development of effective multilevel approaches to improve current and future quality of T2DM care in the South Kivu Province of DRC.

To conceptualize the numerous factors that increase one's risk of developing DM and understand the predictors of self-care behaviors in DM patients, the current study adopted the socio-ecological approach that integrates the

interplay of 5 overarching levels of factors—intrapersonal, interpersonal, institutional, community, and public policy[15]—instead of solely focusing on individual factors.[16] Intrapersonal level comprises sociodemographic characteristics, such as age, education, and employment, and psychosocial and behavioral characteristics, such as motivation, beliefs, attitudes, skills, behaviors, and knowledge about the disease.[17,18] Evidence has shown that the strong belief, particularly that associates the symptoms and complications of DM and related deaths with witchcraft, affects how an individual engages in self-management behaviors for DM.[19,20] Interpersonal level comprises interactions with people surrounding an individual, including family, friends, neighbors, coworkers, and social media networks.[15,18,21] These interactions can provide social support or create barriers preventing an individual from engaging in health-promoting behaviors.[17] Evidence has shown that supportive family behavior is a predictor of self-care practices among patients with T2DM.[22] By contrast, nonsupportive family behavior may lead to distress among patients with T2DM.[23] Institutional level comprises organizational characteristics, such as operating rules, regulations, policies, and informal structures that not only guide how an individual must behave within institutions but also can constrain or promote healthy behaviors.[17] Community level includes availability and location of resources that promote health (eg, availability and accessibility of healthy food stores, health care services, recreation facilities, etc), social networks, and social/cultural norms.[15,18,21] These factors at the community level can limit or enhance healthy behaviors.[17] Public policy level includes local, state, and federal or national policies and laws connecting individuals and the larger social environment. These factors at the public policy level promote healthy actions and practices for disease prevention, including early detection, control, and management.[24] Evidence has shown that lack of both access to care and access to the resources needed to utilize care negatively affect T2DM outcomes.[25] This is why it is important to reach patients with T2DM on multiple levels of the social-ecological model in order to have lasting improvements in quality of T2DM care.

Methods

Research Design

This community-based, cross-sectional study, a research design allowing researchers to collect data from a population at a single point in time, was conducted from February 1 to April 30, 2024, among patients with T2DM in U-KI-SA-LU, South Kivu Province of DRC. Administratively, these 4 cities have a total population of approximately 936,100 inhabitants: Uvira (726,000 inhabitants), Kiliba (55,277), Sange (69,823), and Luvungi (85,000).[26] Swahili is spoken as a second language in these 4 cities,[27] and in this study, all participants were able to speak it clearly.

Study Population

All persons living with T2DM in U-KI-SA-LU, South Kivu Province of DRC, constituted the target population for the study. Participants were sampled and included in the study if they met the following inclusion criteria: (1) age 20 years and above, (2) have been living with diabetes for 6 months or more, and (3) willing to give informed consent. Participants were excluded if they had type 1 diabetes mellitus, could not complete the questionnaires for medical reasons, or refused to participate.

Sample Size and Sampling Method

The sample size of the study was calculated using the formula $n = z^2 \times pq/d^2$ with $p = 25.4\%$, based on a DM study in Bobo-Dioulasso, Burkina Faso[28]; 95% CI; and a 5% margin of error. After adding a 10% nonresponse rate, the total sample size was 328 patients with T2DM. A convenience sampling method was used to consecutively recruit the study participants until the required total sample size was achieved.

Data Collection

The principal investigator (PI) trained the co-principal investigator (Co-PI) about the data collection procedure and ethical issues. Prior to recruiting, the PI and the Co-PI spoke with leaders of churches and mosques, leaders of diabetics associations, and leaders of community diabetes clinics about the study's purpose and significance and sought permission from them to post Institutional Review Board approved recruitment flyers on bulletin boards.

Additionally, announcements were not only made by church or mosque leaders at the pulpit during worship services but also included in church or mosque bulletins. Participant recruitment was held Monday through Thursday at the diabetics association's buildings and community diabetes clinics but mostly on Fridays at the mosques and Sundays at churches to have a large pool of potential participants gathered in one place.

Participants met the Co-PI in a private room at the church or mosque after worship services, diabetics association's building after association meetings, and community diabetes clinics after clinic visits. Each recruited participant completed the questionnaires voluntarily for about 25 minutes.

Measures

The data were collected using structured pretested questionnaires. The 3 pretested questionnaires, sociodemographic and clinical characteristics, diabetes knowledge, and diabetes self-care practices, were prepared in the English language by the PI after an intensive literature review focusing on the objectives of this study. Afterward, the questionnaires were translated to the Swahili language and then back-translated into English to ensure accuracy. Both the English and Swahili questionnaires were administered to 4 uninvolved and unbiased health care professionals in order to check for translation-based discrepancies. The Swahili questionnaires were modified based on health care professionals' feedback. For a final adjustment, the modified Swahili questionnaires were then piloted among 12 random participants who met the inclusion criteria. Based on the feedback from the pilot participants, Swahili questionnaires were further modified not only to ensure clarity of questions but also to ensure that the questionnaires took no more than 25 minutes to complete.

The Swahili questionnaires were then finalized and used to collect the data.

The participants' sociodemographic and clinical characteristics included age, gender, sex, marital status, education status, years with T2DM, current treatment, and city of residency. The diabetes knowledge questionnaire used 11 items to assess the knowledge of the participants related to the causes of the disease, importance of diet and exercise versus medication, signs of hyperglycemia and hypoglycemia, and complications of and risk factors of DM. Some questions were provided with 2 categorical responses, "yes" and "no". Other questions had 1 to 4 or 1 to 6 correct responses. Each correct response earned 1 point, and an incorrect response earned 0 point. The diabetes self-care practices questionnaire, a 12-item self-report questionnaire, consisted of 6 domains of diabetes self-care practices. These domains included diet measured, by 3 items; exercise, measured by 2 items; blood sugar testing, measured by 4 items; foot care, measured by 1 item; eye care, measured by 1 item; and smoking, measured by 1 item. Each question earned 1 point for correct practice and 0 point for incorrect practice. However, 3 out of the 12 items had no scoring to minimize agreement bias.

Considering that this study serves as a baseline for future self-management education and support campaign programs, the maximum possible score for diabetes knowledge and self-care practices of participants were 29 and 9, respectively. Participants with above the mean score on DM knowledge or self-care practice questions were considered as having "good knowledge or self-care practices," and participants scoring below the mean on DM knowledge or self-care practice questions were regarded as having "poor knowledge or self-care practices."

Ethical Considerations

Ethical approval was obtained from the California State University, Sacramento Institutional Review Board. Administrative authorization (CNES 001/DPSK/218PP/2023) was obtained from the National Health Ethics Committee in the South Kivu Province of DRC (Comité National d'Ethique de la Santé dans la Province du Sud-Kivu, République Démocratique du Congo). The provision of Helsinki declaration guided the study.[29] Before signing a consent form, each participant received both oral and written information about the objectives and benefits of the study and ensuring strict confidentiality when publishing the data obtained. The participants were also made aware that their participation in the study was voluntary and that they could leave the study at any time. After signing a consent to participate, each participant was given 3 questionnaires to collect (1) sociodemographic and clinical characteristics, (2) diabetes knowledge, and (3) diabetes self-care practices. None of the investigators were involved in the care of the participants.

Data Quality Control and Assurance

The completed questionnaires were checked daily by the Co-PI and reviewed weekly by the PI to ensure completeness and consistency. A double data entry technique was used.

Data Analysis

Statistical analysis was performed using SPSS version 26.0 (IBM, Chicago, IL). Categorical variables were expressed as percentages. Means and standard deviations were calculated for continuous variables. The analysis also involved conducting *F* statistic for the analysis of variance (ANOVA) test to determine the association between sociodemographic and clinical characteristics of study participants and knowledge level and self-care practice level. The means were observed with a 95% CI, and a *P* value of $<.05$ was considered statistically significant.

Results

Sociodemographic and Clinical Characteristics of Participants

For the 328 study participants, ages were between 20 and 90 years (mean age, 58.1 ± 13.2 years), 179 (54.6%) were men, and 149 (45.4%) were women. The majority of the study participants were married (n = 244; 74.4%), and 109 (33.2%) belonged to 60 to 69 years age group. More than half of the participants had either no formal education (n = 110; 33.5%) or a primary education (n = 105; 32.1%). The duration of living with T2DM varied among participants; 3 (0.9%) participants had T2DM for 6 months to 1 year, 137 (41.8%) for 1 to 5 years, 102 (31.1%) for 6 to 10 years, 68 (20.7%) for 11 to 20 years, and 18 (5.5%) for more than 20 years. Moreover, only 19 (5.8%) of the participants reported diet and physical exercise as their treatment modality; the majority of the participants were either on oral medications (n = 171; 52.1%), insulin injection (n = 56; 17.1%), or a combination of insulin and oral medications (n = 82; 25%). One hundred twelve (34.2%) participants lived in the city of Uvira, 6 (1.8%) in the city of Kiliba, 110 (33.5%) in the city of Sange, and 100 (30.55) in the city of Luvungi (Table 1).

Knowledge Level of Participants About DM

More than half of the participants acknowledged that healthy eating and more physical activity could help control DM (n = 221; 67.4%), DM was not curable (n = 203; 61.9%), insulin could not cure DM (n = 199; 60.7%), and a patient with T2DM did not have to take insulin all his or her life (n = 197; 60.1%). However, only 136 (41.5%) knew that diabetic medications were not more effective than diet or physical activity, 129 (39.3%) knew that DM was not hereditary, and 113 (34.5%) knew that eating too much sugar and other sweet foods was not a cause of DM (Table 2).

When queried about signs of hypoglycemia, more than half of the participants were aware of excessive sweating (n = 223; 68.0%), fatigue (n = 215; 65.5%), hunger (n = 207; 63.1%), and headache (n = 176; 53.7%). Additionally, more than half of them were aware that increased urination (n = 241; 73.5%), increased thirst (n = 227; 69.0%), dry mouth (n = 199; 60.7%), and blurred vision (n = 193; 58.8%) were signs of hyperglycemia. However, more than half of them were not aware that urinary infections (n = 201; 61.3%) and unintentional weight loss (n = 179; 54.6%) could also be signs of hyperglycemia (Table 2).

In terms of complications of DM, the majority of the participants knew about the association between DM and complications such as eye problem or even blindness (n = 254; 77.4%) and foot infections (n = 224; 68.3%). However, it is worth noting that less than half of the participants knew that kidney failure (n = 150; 45.7%), heart failure (n = 149; 45.4%), neuropathy (n = 140; 42.7%), and lung problems (n = 100; 30.5%) could also be complications of DM. It was also noted that about three-fourths of the participants had knowledge about the association between risk factors such as prediabetes (n = 245; 74.7%) and a genetic or family history of DM (n = 232; 70.7%). Moreover, 172 (52.4%) participants were aware that overweight or obesity could lead to DM. However, only 117 (35.4%), 112 (34.2%), and 86 (26.2%) had knowledge about the connection between DM and being 45 years old or older, gestational DM, and low physical activity, respectively (Table 2).

Overall, the total mean score for correct answers on DM knowledge questions was 16.68 ± 5.24 (Table 4). One hundred eighty-eight (57.3%) participants scored above the mean and were regarded as having good knowledge about DM, and the remaining 140 (42.7%) who scored below the mean were poorly knowledgeable.

Table 1. Sociodemographic and Clinical Characteristics of the Study Population (N = 328)

Variables	Categories	Frequency	Percentage (%)
Age, y	Mean ± SD: 58.1 ± 13.2		
	20-29	8	2.5
	30-39	26	7.9
	40-49	43	13.1
	50-59	76	23.2
	60-69	109	33.2
	70-79	56	17.1
	80-89	9	2.7
	≥90	1	0.3
Gender			
	Male	179	54.6
	Female	149	45.4
Marital status			
	Married (marié ou mariée)	244	74.4
	Unmarried (célibataire)	5	1.5
	Separated/divorced (séparé ou divorcé)	13	4
	Widowed (veuf ou veuve)	66	20.1
Education status			
	No formal education	110	33.5
	Primary/elementary	105	32.1
	Secondary/high school	86	26.2
	Vocational training	18	5.5
	College	9	2.7
Diabetes duration			
	6 mo to <1 y	3	0.9
	1-5 y	137	41.8
	6-10 y	102	31.1
	11-20 y	68	20.7
	>20 y	18	5.5
Current treatment			
	Insulin injection	56	17.1
	Oral medication	171	52.1
	Insulin injection and oral medication	82	25
	Diet and physical exercise	19	5.8
City of residency			
	Uvira	112	34.2
	Kiliba	6	1.8
	Sange	110	33.5
	Luvungi	100	30.5

Self-Care Practice Level of Participants Towards DM Control

Self-care practices among the study participants are indicated in Table 3. When queried about eating green leafy vegetables, the investigation revealed that over the past 7 days, 137 (41.8%) ate green leafy vegetables for 3 or more days. However, only 51 (15.5%) ate fruits for 3 or more days over the past 7 days. Although 176 (53.7%) study participants did exercise for at least 30 minutes, only 120 (36.6%) exercised the minimum recommended 3 days a

Table 2. Frequency Distribution of Study Participants' Knowledge Regarding Diabetes Mellitus (N = 328)

	Correct answers		Incorrect answers	
Questions to assess knowledge	**Frequency**	**%**	**Frequency**	**%**
Is DM hereditary? (0-1)	129	39.3	199	60.7
Is eating too much sugar and other sweet foods a cause of DM? (0-1)	113	34.5	215	65.5
Is DM curable? (0-1)	203	61.9	125	38.1
Can insulin cure DM? (0-1)	199	60.7	129	39.3
What are the signs of hypoglycemia? (0-4)				
Excessive sweating	223	68	105	32
Fatigue	215	65.5	113	34.5
Headache	176	53.7	152	46.3
Hunger	207	63.1	121	36.9
What are the signs of hyperglycemia? (0-6)				
Increased thirst	227	69.2	101	30.8
Increased urination	241	73.5	87	26.5
Dry mouth	199	60.7	129	39.3
Frequent skin and urinary infections	127	38.7	201	61.3
Blurred vision	193	58.8	135	41.2
Unintentional weight loss	149	45.4	179	54.6
What are the complications of DM? (0-6)				
Eye problem or even blindness	254	77.4	74	22.6
Foot infections	224	68.3	104	31.7
Heart failure	149	45.4	179	54.6
Kidney failure	150	45.7	178	54.3
Neuropathy	140	42.7	188	57.3
Lung problems	100	30.5	228	69.5
Does a diabetic patient have to take insulin all his/her life? (0-1)	197	60.1	131	39.9
Can healthy eating and more physical activity help you control your DM? (0-1)	221	67.4	107	32.6
Diabetic medications are more effective than diet or physical activity? (0-1)	136	41.5	192	58.5
What are the risk factors of DM? (0-6)				
Prediabetes	245	74.7	83	25.3
Overweight and/obesity	172	52.4	156	47.6
Being 45 y old or older	117	35.7	211	64.3
Genetic or family history of DM	232	70.7	96	29.3
Low physical activity	86	26.2	242	73.8
Gestational DM	112	34.1	216	65.9
Overall diabetes knowledge (Mean: 16.68 ± 5.24)	Good knowledge (above the mean): 188 (57.3%)		Poor knowledge (below the mean): 140 (42.7%)	

Abbreviations: DM, diabetes mellitus.

week. Only 136 (41.5%) were performing the daily self-foot examination, whereas 111 (33.8%) had never examined their feet. Surprisingly, 167 (50.9%) participants reported that they never had an eye examination in their lifetime. A very small proportion of the study participants were smokers (n = 9; 2.7%). On the other hand, 135 (41.2%) of the participants monitored their blood sugar levels once a month, and 103 (31.4%) had their blood sugar levels checked only when they were hospitalized. This could have been a result of lack of a glucometer given

Table 3. Self-Care Practices Among Study Participants

Questions on self-care practices	Responses	Frequency	%
On how many of the last 7 days did you eat green leafy vegetables?			
	Not even 1 day in the last 7 days	65	19.8
	1 or 2 days in the last 7 days	126	38.4
	≥3 days in the last 7 days[a]	137	41.8
On how many of the last 7 days did you eat fruits?			
	Not even 1 day in the last 7 days	155	47.3
	1 or 2 days in the last 7 days	122	37.2
	≥3 days in the last 7 days[a]	51	15.5
On how many of the last 7 days did you eat sweets?			
	Not even 1 day in the last 7 days[a]	153	46.6
	1 or 2 days in the last 7 days	120	36.6
	≥3 days in the last 7 days	55	16.8
Do you exercise[b] for at least 30 minutes?			
	Yes[a]	176	53.7
	No	152	46.3
On how many of the last 7 days did you exercise for at least 30 minutes?			
	Every day[a]	80	24.4
	4 to 6 days in the last 7 days[a]	32	9.8
	3 days in the last 7 days[a]	8	2.4
	2 days in the last 7 days	37	11.3
	1 day in the last 7 days	35	10.6
	I did not exercise	136	41.5
How often do you check your blood sugar levels?			
	Every day[a]	18	5.4
	Twice a week	32	9.8
	Once a week	40	12.2
	Once a month	135	41.2
	Only when I get hospitalized	103	31.4
How often do you examine your feet?			
	Every day[a]	136	41.5
	Twice a week	17	5.2
	Once a week	28	8.5
	Once a month	27	8.2
	Once a year	9	2.8
	Never examined my feet	111	33.8
How often do you have your eyes checked?			
	Once a month[a]	55	16.8
	Every 3 months[a]	26	7.9
	Every 6 months[a]	0	0
	Once a year[a]	80	24.4
	Never had my eyes checked	167	50.9
Do you smoke?			
	No[a]	319	97.3
	Yes	9	2.7
Overall self-care practices (Mean: 4.87 ± 1.59)		Good self-care practices Only 149 (45.43%)	

(continued)

Table 3. *(continued)*

Questions on self-care practices	Responses	Frequency	%
Non-Scoring Questions			
Do you have a glucometer at home?			
	Yes	77	23.5
	No	251	76.5
Do you check your blood sugar with glucometer by yourself?			
	Yes	67	20.4
	No	261	76.5
Where do you check your blood sugar?			
	At home by glucometer	47	14.3
	In the laboratory at the hospital or clinic	251	76.5
	Both	30	9.2

[a]Good self-care practice.
[b]Exercise = continuous activity, including walking, biking.

Table 4. Mean Scores of the Study Participants

Variables	Mean	SD	Minimum	Maximum
Knowledge (29 points)	16.68	±5.24	5	29
Self-care practices (9 points)	4.87	±1.59	2	9

that only 77 (23.5%) had a glucometer at home, with the rest checking their blood sugar levels in the laboratory at the hospital or clinic. Generally, the total mean score for correct answers on self-care practice questions was 4.87 ± 1.59 (Table 4). Only 149 (45.43%) participants scored above the mean and were considered to have good self-care practices toward DM, and 179 (54.57%) scored below the mean and were regarded as having poor self-care practices.

Association Between Sociodemographic and Clinical Characteristics of Study Participants and Knowledge Level and Self-care Practice Level

The association between sociodemographic and clinical characteristics of study participants and knowledge level and self-care practice level is presented in Table 5. It was found that being married ($P = .01$), having higher educational ($P = 0$), and being on insulin injection ($P = 0$) were significantly associated with good knowledge level according to F statistic for the ANOVA at a significance level of $<.05$. Being married ($P = .0023$) also exhibited a significant association with good self-care practice level using F statistic for the ANOVA at a significance level of $<.05$.

Discussion

This community-based, cross-sectional study is the first study to report on knowledge and self-care practices related to DM among patients with T2DM in U-KI-SA-LU, South Kivu Province of DRC. Prior research has suggested that proper knowledge and self-care behaviors are required to effectively manage and minimize the complications of DM.[30-32] This study found that there were more male than female participants (n = 179 males, 54.6%; n = 149 females; 45.4%). These findings are similar to a study on DM in Kimpese, DRC (56% vs 44%)[33]; Panzi, DRC (57.1% vs 42.9%)[34]; and Central Nepal (66.7% vs 33.3%).[35] In line with this observation, worldwide in adult populations ages 20 to 79 years, DM has been found to be more prevalent in men than in women (10.8% in men vs 10.2% in women), suggesting that about 17.7 million more men than women worldwide had DM in

Table 5. Knowledge and Self-Care Practices Toward Diabetes Mellitus and Their Association With Sociodemographic and Clinical Characteristics

			Knowledge score out of 29			Self-practice score out of 9		
Variable	**N**	**%**	**Mean**	**SD**	***P value***	**Mean**	**SD**	***P value***
Age					.79			.58
20-29	8	2.5	14.5	±5.51		4	±0.82	
30-39	26	7.9	15.96	±6.16		4.73	±1.48	
40-49	43	13.1	16.44	±4.95		4.82	±1.53	
50-59	76	23.2	16.63	±5.26		5.03	±1.46	
60-69	109	33.2	16.93	±5.36		4.88	±1.65	
70-79	56	17.1	17.13	±5.36		4.87	±1.73	
80-89	9	2.7	16.67	±4.33		4.11	±1.83	
≥90	1	0.3	17	0		2	0	
Gender					.38			.54
Male	179	54.6	16.44	±5.42		4.85	±1.60	
Female	149	45.4	16.96	±5.0		4.81	±1.54	
Marital status					.01			0
Married (marié ou mariée)	244	74.4	16.87	±5.18		5.06	±1.58	
Unmarried (célibataire)	5	1.5	9.2	±2.77		4.8	±.84	
Separated/divorced (séparé ou divorcé)	13	4	15.62	±4.70		4.54	±1.40	
Widowed (veuf ou veuve)	66	20.1	16.74	±5.34		4.24	±1.54	
Education status					0			.21
No formal education	110	33.5	13.57	±4.17		4.68	±1.62	
Primary/elementary	105	32.1	16.19	±4.65		4.7	±1.54	
Secondary/high school	86	26.2	16.28	±5.36		5.13	±1.56	
Vocational training	18	5.5	17.88	±4.81		4.62	±2.07	
College	9	2.7	20.12	±3.09		5	±1.61	
Diabetes duration					.08			.54
6 mo to <1 y	3	0.9	12.33	±.58		4.53	±1.30	
1-5 y	137	41.8	16.03	±5.22		4.74	±1.61	
6-10 y	102	31.1	17.59	±5.48		4.81	±1.51	
11-20 y	68	20.7	16.51	±4.90		4.96	±1.56	
>20 y	18	5.5	17.88	±4.81		5.35	±1.80	
Current treatment					0			0.07
Insulin injection	56	17.1	17.96	±5.10		4.93	±1.55	
Oral medication	171	52.1	17.51	±4.66		5.02	±1.61	
Insulin injection and oral medication	82	25	14.88	±5.76		4.48	±1.51	
Diet and physical exercise	19	5.8	14.25	±5.27		4.68	±1.48	

2021.[36] Additionally, the mean age of 58.1 years in the current study is consistent with not only the mean age in Kimpese, DRC (57.5 years) [33]; Adama, Ethiopia (58 years)[37]; and Durban, South Africa (59 years),[38] but also global figures of people with DM.[39] Furthermore, a study conducted in Kimpese, DRC, reported that of the 184 study participants, 129 (70%) were between the ages of 50 and 69.[33] Even though this proportion is higher than the one found in the current study of 328 participants, this status is consistent with the current study that reports that 185 (56.4%) participants were between the ages of 50 and 69.

The current study revealed that the participants with T2DM had good general knowledge about DM (n = 188; 57.4%). This is in line with studies on DM knowledge conducted in Cotonou, southern Benin (53%)[40]; Debre Berhan town, northeast Ethiopia (56.02%)[41]; the Bale zone, Ethiopia (52.5%)[42]; and Khartoum, Sudan (51.4%).[43] In contrast, studies conducted in different geographical regions in DRC and other SSA countries found general DM knowledge to be poor, such as in Kimpese, DRC (72.3% with poor knowledge)[33]; Panzi, DRC (poor with regard to risk factors, 76.6%, and complications, 91%)[34]; Somalia (68%)[44]; and Nigeria (70.1%).[45] Even though knowledge is the greatest weapon in the fight against DM,[44] DM patients across different SSA countries lack access to proper information and education on how to manage their disease, which is primarily due to limited health care infrastructure, a shortage of trained health care providers, and a lack of awareness campaigns.[46] This is consistent with a study in Kenya that found that 60% of patients diagnosed with DM were not receiving treatment,[47] and in Africa in general, only 46% of people with DM know their status.[48] Although behavior changes and intensive lifestyle interventions focused on dietary adjustments and exercise hold a fundamental part of the management of T2DM,[49] more than half of the current study participants 179 (54.57%) had poor self-care practices. In this study, 221 (67.4%) participants acknowledged the benefits of healthy eating and physical activity in controlling T2DM; however, over the past 7 days, only 137 (41.8%) ate green leafy vegetables, 51 (15.5%) ate fruits for 3 or more days, and 120 (36.6%) exercised the minimum recommended 3 days a week, suggesting that efforts should be geared toward closing the gap by linking knowledge with reasonable practices related to DM. A study by Alaofè et al[40] found similar results in Cotonou, Benin, in which only 30% reported having a meal plan and exercising every day even though 47% and 61% of the participants were knowledgeable about the benefits of exercise and a healthy diet, respectively. Along the same lines, the current study found that 167 (50.9%) never had their eyes checked, 111 (33.8%) never examined their feet, and 103 (31.4%) had their blood sugar levels checked only when they were hospitalized. Goie and Naidoo[38] found similar results in Durban, South Africa, where only 22.2% of participants examined their feet only when they experienced a problem. Smoking accounts for more than half of the risks contributing to peripheral artery disease and diabetic foot disease (DFD) among patients with DM,[50,51] with DFD accounting for 5% of all lower limb amputations.[52] However, it was encouraging that in the current study, only 9 (2.7%) participants smoked cigarettes, which may be related to the fact that SSA has the lowest smoking prevalence globally.[53] A study conducted in Tigray, Ethiopia, found that having a glucometer at home and knowing blood sugar level were significantly associatiated with good self-care practices.[54] This is consistent with studies conducted in different parts of Ethiopia, such as Addis Ababa, Ethiopia,[55] and Benishangul Gumuz, Ethiopia.[56] Unfortunately, in the current study, the availability of a personal glucometer at home was very low (n = 77; 23.5%). Similar findings of a low rate of personal glucometer use were reported in Durban, South Africa (21.4%),[38] and Cotonou, Benin (20.3%).[40]

Studies in Nigeria[57] and Nepal[35] have found that a higher level of education was significantly associated with DM knowledge among DM patients. This is in line with findings among DM participants in the current study. The most likely explanation is that participants with college-level education may have already obtained knowledge on DM and its management through several platforms. Finally, in the current study, married participants were associated with both good DM knowledge and self-care practices. The probable explanation is that married participants may have gained economic and psychosocial support from their family or household members. There is evidence that social-environmental support is positively associated with improved T2DM self-management behaviors.[58]

Strength and Limitations

To the best of our knowledge, this study is the first to assess the knowledge and self-care practices related to DM among T2DM patients in U-KI-SA-LU, South Kivu Province of DRC. It provides valuable data that would serve as a template for further studies on DM and its complications in the South Kivu Province. Another strength for this study lies in its data collection from 4 cities, providing a more representative sample. However, it has certain limitations. First, being a cross-sectional study makes it difficult to determine causal relationships between variables. Second, because the study not only asks about self-care practices for the past 7 days but also is based on self-reports, the performance of the participants' self-care behaviors could not be confirmed. Third, another limitation could be because this study was conducted on patients with T2DM without assessing their comorbidities, their glycated haemoglobin (HbA1C), or DM complication status during the data collection period. Fourth, because some of the questions used in this study are closed-ended, responses may have been guessed by the participants. Future studies are needed to shed light on such factors.

Implications for Practice and Research

This community-based, cross-sectional study will inform researchers and stakeholders of the key implications when designing and implementing DM self-management education and support in U-KI-SA-LU, South Kivu Province of DRC. To achieve lasting improvements in the quality of T2DM care, key strategies are needed. First, it is important to incorporate culturally sensitive diabetes education programs and provide coordinated care by involving a multidisciplinary team, including primary care providers, diabetes specialist nurses, nutritionists, pharmacists, and psychologists. Second, it is crucial to deeply consider the impact of spirituality and faith-based interventions on DM management. Fine, Fit, and Fabulous, a 12-week faith-based diabetes prevention program for Black and Latino congregants at churches in low-income New York City neighborhoods that included nutrition education and fitness activities while incorporating Bible-based teachings that encourage healthy lifestyles, accounted for statistically significant improvements in participants' knowledge and healthy behaviors related to healthy eating and exercise.[59] Third, it is crucial to consider the significant impact of religious leaders and faith-based communities, including churches, synagogues, mosques, meeting houses, and other places of worship, on the lives of members of the communities. Religious leaders, such as pastors, bishops, priests, imams, and deacons, play a powerful role in shaping attitudes, opinions, and behaviors because they are often the most respected and trusted figures in their communities. Fourth, it is important to involve family in diabetes management because family members can provide patients with DM with a range of support, including self-care, lifestyle changes, and social and emotional support. Research consistently shows that family support is essential for improving well-being and self-management of DM.[60] Fifth, it is important to consider the role of traditional media, including print advertising, television, radio, and newspapers, to reach out to all communities for raising DM awareness, education, and support campaigns.

Conclusion and Recommendations

This study provides a snapshot of the current level of knowledge and self-care practices related to DM among patients with T2DM in U-KI-SA-LU, South Kivu Province of DRC. Although more than half of the study participants had good general knowledge about DM, nearly half of the participants still had poor knowledge, indicating a need for improvement in knowledge to better manage DM and reduce the risk of complications. This study found a gap between knowledge and self-care practices about DM. Participants' good knowledge about DM did not translate into good self-care practices given that over half of the study participants had poor self-care practices. Therefore, the current study findings suggest that there is a need for DM awareness, education, and support campaigns in U-KI-SA-LU, South Kivu Province of DRC, to not only reduce the chances to develop complications of DM but also reduce morbidity and mortality in DM patients. These findings also suggest that there is a need for ensuring health care professionals are well informed about their role in DM management through not only educational campaigns but also traditional media, including print advertising, television, radio, and newspapers. The use of the socio-ecological approach, as in this study, could inform future DM self-management education and support programs by considering factors at various levels that influence people's ability to manage their DM.

Acknowledgments

This article is specifically part of the Diabetes Project Uvira-Kiliba-Sange-Luvungi (Projet Diabète U-KI-SA-LU), which falls under the umbrella of the Africa Institute for Diabetes Self-Management, with overall efforts to empower people affected with diabetes to thrive beyond diabetes through diabetes self-management education and support. The authors would like to acknowledge and express their deep appreciation to the study participants for giving their time and providing the information presented in this article. The authors are deeply grateful to Dr Graciela Silva (University of Arizona, College of Nursing and College of Public Health) for helping with data analysis. The authors would like to express their sincere gratitude to church leaders: Révérend Pasteur Yambayamba Mwayaye et Pasteur Victor Ndawabo (Directeur du Bureau de Reboisement de la 8e CEPAC) de l'Eglise 8e CEPAC Bethel Kimanga and other church leaders who generously facilitated our research study at their places of worship. The authors would also like to express their gratitude to Médecins Directeurs des Centres Hospitaliers, Médecins Directeurs des Centres de Santé, Médecins Chefs des Zones de Santé d'Uvira et Ruzizi, Responsable de la Mutuelle de Santé (MUSA), Responsable de la Mutuelle de Solidarité (MUSO), and Responsable de l'Association Paysanne d'Epargne et de Crédit (AVEC). Last but not least, the authors would like to gratefully acknowledge the following volunteers for their invaluable assistance with data collection: Mukono Balire Jean-Marie (Président de l'Association Espoir des Diabétiques, Luvungi), Gize Gamale (Enseignant à l'Institut Katala/Nyakabere), Kaskile Bigakiba Muhigimba (Expert en Santé Publique), Majaliwa Busigo Dan (Psychologue clinicien-HGR Ruzizi), Butoto Kwigwasa Claude (Infirmier Traitant au Centre de Santé

Sange 8e CEPAC, Sange), Jojo Ndanda (Enseignant/Professeur d'Anglais à l'Institut Usalama), Mishuli Justin Owazis (Étudiant en psychologie clinique à l'Université Officielle de Bukavu «U.O.B»), Basimise Byamungu (Enseignant à l'E.P Kasenga/Uvira), Elie Mikolwa (Psychologue clinicien), and Yusufu Ruharuka Abel (Psychologue clinicien).

Authors' Contributions

Dr Kindarara conceived and designed the study, performed data analysis and interpretation of data, and drafted the manuscript. Juslin Bamu Murondere conducted and supervised data collection. Both authors reviewed and approved the final manuscript.

Declaration of Conflicting Interests

The authors declare that they have no competing interests.

Funding

None. The authors did the study by their own funding.

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