

Outcome of Educational Intervention on Knowledge and Attitude Towards Prevention of Diabetes Mellitus among Community-Based Science Teachers Used as trainers in Two Selected Public post-primary schools in Southern Nigeria

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ABSTRACT

INTRODUCTION: In recent times, the prevalence of diabetes mellitus (DM) has been on the increase in developing countries, including Nigeria. Studies have suggested adopting “task shifting” to train non-health personnel for DM prevention activities. This small-scale pilot study aimed to determine the outcome of an educational intervention on knowledge and attitude toward the prevention of DM among community-based science teachers used as trainers in two selected public post-primary schools in southern Nigeria.

METHODS: This mixed-method design study was conducted on all eleven science secondary teachers in the two public community schools (Agbon Secondary School and Owa Ekei Model School). Data were collected using an in-depth interview guide and a validated semi-structured questionnaire. Data was analysed using descriptive and inferential statistics, using the Wilcoxon test at a $p < 0.05$ significance level.

RESULTS: The age of the teachers was 38.91 ± 7.4 years. The qualitative findings showed high awareness of DM, but significant gaps in knowledge on some of the components of DM. The quantitative findings showed a significant increase in the mean knowledge (3.1 ± 1.6 vs 11.3 ± 3.2), perception (6.6 ± 3.1 vs 16.4 ± 4.4), and attitude (7.5 ± 3.2 vs 13.2 ± 4.4) scores at post-test when compared with the pre-test at $p < 0.05$.

CONCLUSION: The findings though a feasibility study showed trained teachers as promising potential change agents and could be used as part of task shifting in DM health promotion activities.

Keywords: Diabetes Mellitus, Task Shifting, Perception, Secondary School Science Teachers, Public Schools

INTRODUCTION

Diabetes mellitus is a chronic condition that occurs when the body is unable to produce enough or

use insulin properly, resulting in excessive levels of glucose in the blood [1]. There are three main types of DM: type-1, type-2, and Gestational DM (GDM) [1].

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The pooled prevalence of DM in Nigeria shows the South-South has the highest prevalence of 9.80% and the least was the North-West geopolitical zone with 3.0% [2], with a national reported prevalence of 2.2% [3]. The increasing frequency of DM spans across all sectors of the nation, including both rural and urban communities. In rural highlands, the prevalence of DM was reported to range from 0.8% to over 7%, whereas in metropolitan Lagos, the prevalence was above 7% [3].

In Delta State, Southern Nigeria, available reported studies have shown a high prevalence of diabetes mellitus in communities [4–8]. Compounding the problem is the poor organisation of diabetes care in the community and health facilities [9]. Furthermore, lack of awareness and knowledge of DM, including myths on its causes, has been reported across communities in Delta State [9–11]. This poor state of diabetes care in Delta State has resulted in 65% chronic complications among type-2 diabetes patients, with reported complications such as nephropathy, dyslipidaemia, hypertension, neuropathy, and retinopathy [6]. These complications have led to diabetes related mortality among DM patients [12], which has resulted in loss of manpower, as most diabetes patients are still in their productive age [6]. Therefore, to reduce the prevalence of the disease and mitigate its effect on the population, there is a need for a more holistic approach by adopting the strategy of “task shifting”.

Task shifting is defined by the World Health Organisation (WHO) as “the rational redistribution of tasks among health workforce teams”, from trained and qualified health workers to other health workers with shorter training duration, to maximise the available health workforce [13]. Task shifting is implemented in many countries globally, including Africa, where there remains a persistent health workforce shortage and deficient access to healthcare [14]. Consequently, the implementation of a diabetes training and educational intervention programme among teachers for them to act as change agents in creating awareness and knowledge of diabetes mellitus would ensure that inhabitants of communities have sufficient knowledge of the condition and develop positive perceptions towards the disease. This is because teachers are highly respected figures in rural Nigerian communities and often serve as key influencers. Their existing relationships with young

adults make them effective in delivering health education, as learners are more likely to trust and adopt messages from familiar authority figures. Also, rural communities often face healthcare worker shortages, making teacher-led education a practical alternative. Teachers are already present in these areas and can disseminate knowledge effectively, even where healthcare access is limited. This study was designed to investigate the outcome of educational intervention on knowledge and attitude toward the prevention of diabetes mellitus among community-based science teachers used as trainers in Southern Nigeria. This study aimed to demonstrate the importance of utilising non-healthcare personnel as trainers to stimulate actions towards improving knowledge and attitudes towards the prevention of diabetes mellitus in communities.

METHODS

Study Design and Settings

This study employed a mixed-methods design for teachers who were trained as trainers. The design of the study was to demonstrate that existing structures in the community, such as secondary school teachers, could be used as training-of-trainers in DM prevention. In addition, the current study was part of a broader study where teachers were recruited as trainers to train volunteer young adults. However, the scope of the current study focused on teachers who were recruited as trainers. The checklist for the Transparent Reporting of Evaluations with Non-Randomised Designs (TREND) statement was used for reporting [15].

Study Population

The study population was science-based teachers, both males and females, from the two secondary schools who were trained as trainers. The following subjects were taught by the teachers to be included in the study. Health education, physical and health education, basic education, biology, and the requirement that study participants provide informed consent.

The criteria for exclusion were teachers not teaching any of the stated subjects of Health Education, Physical and Health Education, Basic Education, Biology, and those teachers who did not give informed consent to participate in the study.

Sample Size

The study employed a total sampling technique in purposively selecting all the teachers who fulfilled the inclusion criteria of the study. Overall, all eleven science-based teachers were selected from both secondary schools in the two communities. Five from Agbon College, Isiokolo in Ethiopie-East LGA, and six from Owa Secondary School in Ika North East LGA.

Sampling Procedure

First Stage: Out of the 3 senatorial districts in Delta State, LGAs were stratified based on rural and urban regions (10 urban LGAs and 15 rural LGAs) [16] and based on the reported prevalence of DM from previous research [4,5]. Consequently, among the 15 rural LGAs, 2 LGAs were randomly selected by balloting. Thus, Ethiopie-East LGA and Ika North-East LGA were selected.

Second Stage: The second step comprises stratifying into communities in Ethiopie-East and Ika North-East local government regions. Eleven communities were recognized in Ethiopie-East and seventeen communities in Ika North-East local government districts. The eleven communities in Ethiopie-East included Kokori, Okpara, Ovu, Orhokpo, Isiokolo, Igun/Waterside, Abraka PO, Oria, Erhovie, Eku, and Samagidi, while the seventeen communities identified in Ika North-East included Umunede, Akumazi, Owerre Olubor, Ute gbeje, Ali Nwachokor, Ekwuoma, Igbode, Owa Oyibu, Owa Nta, Aliosome, Owa Ekei, Otolokpo, Ute Okpu, Ute Eremu, Ute Enugu, Ute Aliohen, and Owa Alero. Through balloting, one community from each of the recognised communities in the designated local governments was randomly selected. Thus, Isiokolo community was selected from Ethiopie-East local government, while Owa Ekei community was selected from Ika North-East local government.

Third Stage: Out of the two government-owned secondary schools in Isiokolo, Agbon College Isiokolo and Anibor Standard Secondary School, Isiokolo. Agbon College, Isiokolo, was randomly selected by balloting in Ethiopie-East Local Government Area, whereas Owa Secondary School was purposively selected for Ika North-East Local Government Area because this was the government-owned secondary school serving Owa-Ekei quarters.

Fourth Stage: Thereafter, the teachers teaching health-related subjects such as health education, physical and health education, basic education,

and biology were purposively recruited as trainers. In all, eleven available teachers who met the inclusion criteria in both schools were sampled for the study.

Instrument for Data Collection

A prepared In-depth Interview (IDI) guide was used to conduct the IDIs by the researcher, assisted by the recruited research assistants on an agreed day to assess their knowledge and attitude towards DM. All Health Education, Physical and Health Education, Basic Science, and Biology teachers were interviewed in the IDIs. Eleven IDIs were conducted. Each session was conducted in the teacher's office. Each session lasted 45 minutes to one hour on average. To maintain privacy, the teachers were provided with appropriate information about the study's objective and requirements. There was also a request for approval to employ the audio digital recording.

The quantitative instrument for data collection was a validated questionnaire developed by the researcher and was adapted from previous studies by the researcher [17,18], and it comprises four sections. Section one comprised the socio-demographic characteristics of the teachers. Section two contains questions on the knowledge of the teachers on DM, and section three encompasses questions on the perception of DM. Section four was used to appraise their attitudes towards the prevention of DM. The questionnaire was administered at pre-test and post-test intervals.

Method of data collection

A developed IDI guide was utilised by the researcher to carry out interview sessions on designated dates to assess their knowledge and attitude regarding DM. All teachers teaching the key topics of Health Education, Physical and Health Education, Basic Science, and Biology were interviewed. Eleven IDIs were done in total. Thereafter, quantitative data were collected from the teachers using the developed questionnaire. Following that, DM training materials for teachers were prepared utilising the baseline results of both the qualitative and quantitative assessments. Following that, the teachers completed a three-day training with one intervention session held each day, utilising the created DM training curriculum and IDF education training handbook on the numerous facets of DM, beginning with knowledge, management, and prevention, on days that were agreed upon. A post-

training evaluation was also undertaken with the trained teachers following the session. This aided in measuring the results of the training sessions on the teachers

Implementation of the intervention

The International Diabetes Federation has placed a strong emphasis on using educational intervention initiatives to increase community awareness about DM [19].

The intervention was targeted at generating awareness among the teachers and enhancing knowledge, perception, and attitude towards the prevention of DM. The intervention was carried out by a trained Nurse in January 2021 for three days within the school premises. Each session per day lasted from 45 minutes to 1 hour. A pre-testing evaluation activity was conducted to assess the teachers' prior knowledge of DM before the training commenced on the first day, and subsequently, in each of the remaining two days to assess their knowledge of what was taught the previous day before the commencement of training for that day. A post-testing evaluation was performed at the end of each day's sessions to assess the efficacy of the curriculum.

At the start of each session, an overview of the principle behind the training was reinforced during each of the training sessions. There were opportunities for the teachers to ask questions during the training, as comments and responses were offered. The training adopted a participative workshop style.

At the commencement of each session, attendance was taken, followed by feedback and a refresher on the prior topic presented. Then, the theme of the present session was introduced, and an interactive session followed, in which the developed curriculum acted as a guide. These exercises were designed to motivate teachers to apply the lessons learned before the next session. Feedback on past session activities was given before the commencement of another session. The presentations were done in English, and the session was directed by the nurse and aided by the researcher.

The DM prevention curriculum was established based on gaps observed from the baseline survey, inclusion of the IDF education training handbook, and a training book developed for DM peer educators training [20]. The curriculum was a complete training package encompassing information on DM and the adoption of healthy dietary and

physical activity routines, which are crucial for DM prevention. The contents of the training curriculum were grouped into topics, objectives, contents, methods, resources, and evaluation. The training curriculum consists of four modules. Module one consists of the pathophysiology of DM which include the definition and types of DM, description of the role of insulin in glucose uptake, diagnosis, common types and symptoms and risk factors of DM. Module two consists of clarifying myths and misconceptions about DM which consists of mainly the causes of DM especially spiritual and witchcraft causes. Module three consists of self-management practices which include types of medication, healthy dietary choices and physical activities necessary for DM prevention. Module four consists of the role of a diabetes educator which include describing the role of a DM educator, knowledge and skill required by a DM educator and describing the methods of maintaining and increasing skills and knowledge of a DM educator.

The trained teachers were evaluated after one month of training using the same questionnaire at baseline.

Validity and Reliability of Instrument

The developed questionnaire was analyzed for face, content, and construct validity. To test the reliability of the questionnaire, a pre-test was conducted among teachers in Amai Mixed Secondary School in Ukwuani Local Government Area of Delta State for revision of the instrument before commencing the main study. The internal consistency measure (Cronbach's Alpha) of the instrument was used to determine the reliability of the instrument. The Cronbach Alpha score was 0.867.

Data analysis

The audio recordings of the IDIs were translated word-for-word and evaluated manually for themes and content. The qualitative data analysis was accomplished by creating and implementing code, identifying themes, patterns, and linkages, and lastly, summarising data by relating study findings to hypotheses.

First, the transcribed materials were cleaned by reading through them. For each of the research instruments, codes were created and carefully organised in line with the goals of the study. The coding was necessary to categorise parts of the data. The results for each instrument were created and blended the moment all the interview information was coded. Based on the themes

from the specific objectives of the study, content analyses of the themes that had been highlighted were carried out. For the quantitative data, the collected questionnaires for pre- and post-testing were cleaned, coded manually, entered into the computer, and analysed with Statistical Package for Social Sciences (SPSS) version 20.0. Descriptive statistics were used to present the data on frequency tables, charts, and mean scores of knowledge, perception, and attitude towards DM prevention. The non-parametric Wilcoxon signed-rank test was used to show the mean scores and standard deviations at both pre-testing and post-testing. The result of the Wilcoxon signed-rank test was provided as paired differences, which indicated the mean differences between pre-test and post-test scores, Z-statistics, and their associated significant value at $p < 0.05$.

Measurement of Scale

A dichotomous knowledge scale was developed and used to quantify the overall level of knowledge of DM among the students. The sum of the number of test items in the knowledge section of the questionnaire was 17 items. A right answer was scored as 1, while a wrong answer was scored as 0. Therefore, every study participant's knowledge score was categorized between 0-8 as Code 1 and $>8-17$ as Code 2. Respondents that score between 0-8=Code 1 were adjudged to have exhibited poor knowledge of DM prevention, and $>11-23$ =Code 2 as having good knowledge of DM prevention. The knowledge of DM definition and types of DM was measured on a 5-point scale categorized between 0-2 as poor knowledge of DM definition and types and $>2-5$ as good knowledge of DM definition and types. Furthermore, knowledge of DM causes, signs and symptoms, risk factors, complications, management, and prevention were all measured on a 2-point scale categorised as 0-1 as poor knowledge and 2 as good knowledge.

Furthermore, the Health Belief Model constructs (perceived susceptibility, perceived severity, perceived benefits, perceived barriers) were used to measure DM's perception. To measure perceived susceptibility, severity, benefits, and barriers, a dichotomous perception scale (Agree and Disagree) was created. In the perception component of the questionnaire, there were a total of 23 test items. A right answer was scored 1, while a wrong answer scored 0. Therefore,

every study participant's perception score was categorised between 0-11 as Code 1 and $> 11-23$ as Code 2. Respondents who score between 0-11= Code 1 were adjudged to have exhibited a poor perception of DM prevention, and $> 11-23$ = Code 2 as having a good perception of DM prevention. Furthermore, perceived susceptibility was measured in an 8-point perception scale graded 0-4, with Code 1 being poorly perceived susceptibility to DM and $>4-8$ =Code 2 as well perceived susceptibility to DM. In addition, the perceived severity of DM complications was measured on a 5-point perception scale graded 0-2, with Code 1 being the poor perceived severity of DM complications and $>2-5$ =Code 2 as the well perceived severity of DM complications. Perceived benefits of DM prevention were measured in a 5-point perception scale graded 0-2, with Code 1 being poor perceived benefits of DM prevention and $>2-5$ =Code 2 as good perceived benefits of DM prevention. In addition, perceived barriers to DM prevention were measured on a 60-point perception scale graded 0-3, with Code 1 being poorly perceived barriers to DM prevention and $>3-6$ =Code 2 as well well-perceived barriers to DM prevention.

A dichotomous attitudinal scale (Agree, Disagree) was developed. The total number of test items in the attitude section of the questionnaire was eight items. A right answer was scored as 2, while a wrong answer was scored as 0. Therefore, every study participant's attitude score was categorised between 0-8 as Code 1 and $> 8-16$ as Code 2. Respondents who scored between 0-8=Code 1 were assumed to have exhibited a poor attitude towards DM prevention, and $>8-16$ = Code 2 as having a good attitude towards DM prevention. The principles outlined in the Declaration of Helsinki [21] for research involving human subjects were followed. Furthermore, the Delta State Ministry of Health Research Ethics Committee approved the study with approval number HM/596/T/86. In addition, each research subject provided verbal informed consent before the collection of data.

RESULTS

Qualitative findings of knowledge of DM among the teachers

Definition of DM: Most of the definition of DM

by the teachers centred on the consumption of excess sugar.

"Diabetes is defined as having excess sugar in the blood"- (Female Teacher/Sch 1)

"Diabetes is a bad disease that can kill, also known as excessive sugar"- (Female Teacher/Sch 2)

Furthermore, some of the teachers defined DM as a deficiency in insulin production

"Diabetes is a situation where the body in some people is unable to produce insulin, while others can be that there is insulin, but the body is not making use of it"- (Male Teacher/Sch 1)

"Diabetes means a deficiency of insulin production when the body is not able to regulate the sugar in the body"- (Female Teacher/Sch 2)

On the types of DM, most of them were able to mention types 1 and 2, but none mentioned gestational DM. *"Type 1 and 2, Type 1 is diabetic mellitus, while Type 2 is diabetic insipidus"*- (Female Teacher/Sch 1).

The local names of DM mentioned by the teachers corresponded to the ethnicity of the teachers.

"Ovwi sugar (An Urhobo word meaning he/she has sugar or sugar disease)"- (Female Teacher/Sch 1)

"Ogharhevwe (An Urhobo word meaning disease associated with urinating often)"- (Male Teacher/Sch 1)

"Igbe (An Ika word meaning disease associated with when one urinates often)"- (Female Teacher/Sch 2)

Causes of DM: According to the qualitative findings, the causes of DM elicited a mixture of responses from the teachers. Some of the teachers blamed excessive sugar consumption, while others pointed to genetics and low levels of insulin as the causes.

"Too much consumption of sugar"- (Female Teacher/Sch 1)

"Genetic and much consumption of sugar"- (Female Teacher/Sch 2)

"According to history, people say it is hereditary"- (Male Teacher/Sch 2)

If there is a spiritual component to DM causation, the teachers were questioned. The majority affirmed that it does not have a spiritual dimension.

"Nothing of such"- (Male Teacher/Sch 1), *"No, I do not believe it has a spiritual cause"*- (Female Teacher/Sch 1)

However, a few of the teachers affirmed that DM

could be caused spiritually

"I think a spiritual attack may also be to blame"- (Male Teacher/Sch 2)

"Given that it has spread throughout our culture, in my opinion, it is a spiritual practice from bad people"- (Female Teacher/Sch 1)

"Because the underlying causes have not been correctly identified, it has a spiritual component"- (Female Teacher/Sch 2)

Symptoms of Diabetes Mellitus: The symptoms of DM highlighted by the teachers included frequent urination, weakness of the body, weight loss, e.t.c.

"Frequent urination"- (Female Teacher/Sch 1)

"Swellings, rough skin, frequent urination"- (Male Teacher/Sch 1)

"Frequent urination, unable to see well, sores refusing to heal on time, weakness of the body"- (Female Teacher/Sch 2)

"Frequent urination in large volume, increased appetite, poor vision, weight loss"- (Female Teacher/Sch 2)

Risk factors of DM: The risk factors cited by the teachers include hereditary, age, consumption of alcohol, obesity, e.t.c.

"Hereditary and Age"- (Female Teacher/Sch 1)

"Hereditary, consumption of alcohol"- (Female Teacher/Sch 2)

"Hereditary, intake of sugary food, excess body fat"- (Female Teacher/Sch 2)

"Obesity and excessive sugary foodstuff consumption"- (Female Teacher/Sch 1)

Complications of diabetes mellitus: Complications listed for poorly managed DM include eye problems, high blood pressure, stroke, diabetes sores, e.t.c.

"Eye problem, high blood pressure, cataract"- (Male Teacher/Sch 1)

"Brain Loss"- (Female Teacher/Sch 2)

"Diabetic sores"- (Female Teacher/Sch 2)

"Frequent urination"- (Female Teacher/Sch 1)

"When it is poorly managed, the person may undergo an operation"- (Female Teacher/Sch 1)

"It may result in a stroke, watery stools, or eye problems"- (Female Teacher/Sch 2)

"Delay wound healing"- (Female Teacher/Sch 1)

Management of DM: The teachers highlighted a number of DM management strategies, with food, exercise, and drugs being the main focuses.

"Eat healthfully, drink plenty of water, and consume lots of fruit" (Female Teacher/Sch 1)
"Medication use and blood sugar measurements in the daybreak and nightfall"- (Female Teacher/Sch 2)
"Exercise by going for walks every daybreak and nightfall"- (Male Teacher/Sch 2)
"Take food supplement, beans, physical activities" (Male Teacher/Sch 1)

"Visit the doctor regularly, keep an eye on your blood sugar levels, and especially for elderly individuals, limit your salt consumption" (Female Teacher/Sch 2)
 Some of the teachers affirmed the opinion on the herbal management of DM. *"Drinking mixture of bitter leaf, ugu leaf"*-(Female Teacher/Sch 1)
 However, others believe there is no herbal way of managing DM. *"Due to the lack of dose measurements in herbal therapy, I do not believe in it"*- (Female Teacher/Sch 2)
"I am unaware of how to treat diabetes using herbs"- (Female Teacher/Sch 1)

Table 1: Socio-demographic information about Teachers (N=11)

Variable	Frequency	Percentage
Age (Years)		
20-29	1	9.1
30-39	3	27.3
40-49	7	63.6
Mean age: 38.91±7.4 Years		
Sex		
Male	3	27.3
Female	8	72.7
Marital Status		
Single	3	27.3
Married	6	54.5
Widow	1	9.1
Divorced	1	9.1
Religion		
Christianity	11	100
Years of teaching experience		
< 2 years	2	18.2
2-5 years	2	18.2
> 5 years	7	63.6
Subject respondent is teaching		
Biology	5	45.5
PHE	1	9.1
Health Education	2	18.2
Basic Science	3	27.2

Prevention of DM: Prevention of DM, as highlighted by the teachers, is as follows:
"Frequent medical checkup as you grow old"- (Female Teacher/Sch 2)
"Do not take alcohol, avoid smoking"- (Female Teacher/Sch 1)
"Limiting sugar intake, exercising frequently, eating a lot of vegetables, drinking a lot of water, and getting regular checkups"- (Female Teacher/Sch 1)
"Reduce the quantity of carbohydrate intake, avoid taking alcohol, exercise regularly, and go for regular medical checkups to ascertain the level of sugar in the blood" (Female Teacher/Sch 2)

Quantitative findings at pre- and post-test among the teachers

The results in Table 1 show majority (63.6%) of the teachers were between the ages of 40-49 years, with a mean age of 38.9±7.4 years, while 72.7% were females and 54.5% were married. Besides, 63.6% had been teaching for more than 5 years, while 18.2% had been teaching for 2-5 years, and 45.5% were teaching Biology. All the teachers (100%) affirmed being aware of DM, with their sources of information including health workers (36.4%) and the school (36.4%) respectively. Furthermore, only 18.2% affirmed having been diagnosed with DM, while 45.5% mentioned their grandparents as their family member diagnosed with DM.

Teachers' Knowledge at Baseline and Post-Intervention

In Table 2, the overall knowledge of DM shows there was an increase in knowledge of DM from 3.2±1.6 at pre-test to 11.4±3.2 at post-test (p<0.05).

Table 2: Knowledge of Diabetes Mellitus

Variable	Pre-test	Post-test	Z-Statistics	P-value
Definition & types of DM	0.5±0.5	2.3±0.9	-2.724	0.006
Causes of DM	0.3±0.2	1.5±0.6	-2.530	0.011
Signs and symptoms of DM	0.4±0.2	1.5±0.6	-2.762	0.003
Risk factors of DM	0.6±0.5	1.5±0.2	-1.811	0.010
Complications of DM	0.2±0.1	1.6±0.5	-2.879	0.004
Management of DM	0.5±0.2	1.5±0.6	-2.309	0.021
DM Prevention	0.3±0.1	1.4±0.2	-2.460	0.014
Overall, Knowledge	3.2±1.6	11.4±3.2	-2.941	0.003

In Figure 1 at the pre-test, 81.8% of the trainers demonstrated poor knowledge of DM, while 18.2% demonstrated good knowledge of DM. Most of the qualitative data showed the respondents had some measure of knowledge, as presented. At post-test, most of the trainers 72.7% demonstrated good knowledge of DM, while 27.3% demonstrated poor knowledge of DM.

Qualitative findings of Perception of DM among the teachers

Perceived Susceptibility to DM among the teachers
 One of the teachers stated she was susceptible to DM because it is hereditary, while another teacher said she could not have it because she knows how to prevent it. “One could be susceptible to DM

because it is hereditary”-(Female Teacher/Sch 1).
“By God’s grace, I am already watching somebody with the disease, so I cannot contract the disease”- (Female Teacher/Sch 2)
Perceived Severity of DM among the teachers
 The majority of the teachers agreed that DM is a dangerous ailment because it can result in mortality.
“DM is a very serious disease because it could lead to death”- (Female Teacher/Sch 1)
“It is a serious disease because it occurs without noticing it on time”- (Male Teacher/Sch 2)
“It is a dangerous disease; when you contract it, you cannot cure it because it is a chronic disease”- (Female Teacher/Sch 1).

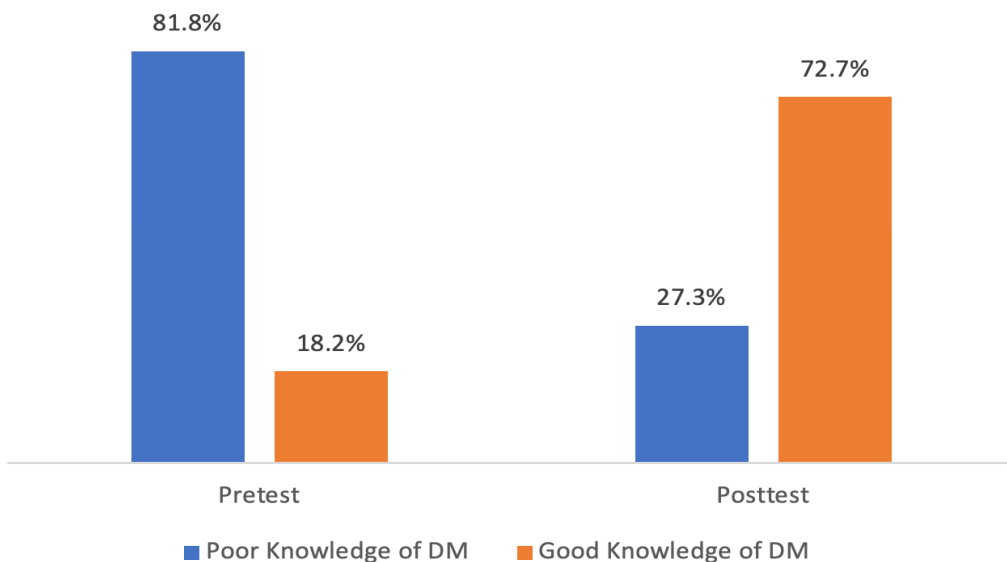


Figure 1: Knowledge of DM at pre-test and post-test among the trainers

Table 3: Perception of Diabetes Mellitus

Variable	Pre-test	Post-test	Z-Statistics	P-value
Perceived Susceptibility	2.81±0.98	5.0±1.89	-2.239	0.025
Perceived Severity	1.27±0.44	3.54±1.36	-2.821	0.005
Perceived Benefits	1.09±1.02	3.72±1.27	-2.953	0.003
Perceived Barriers	1.45±1.13	4.18±1.94	-1.473	0.141
Overall Perception	6.63±3.13	16.45±4.48	-2.941	0.003

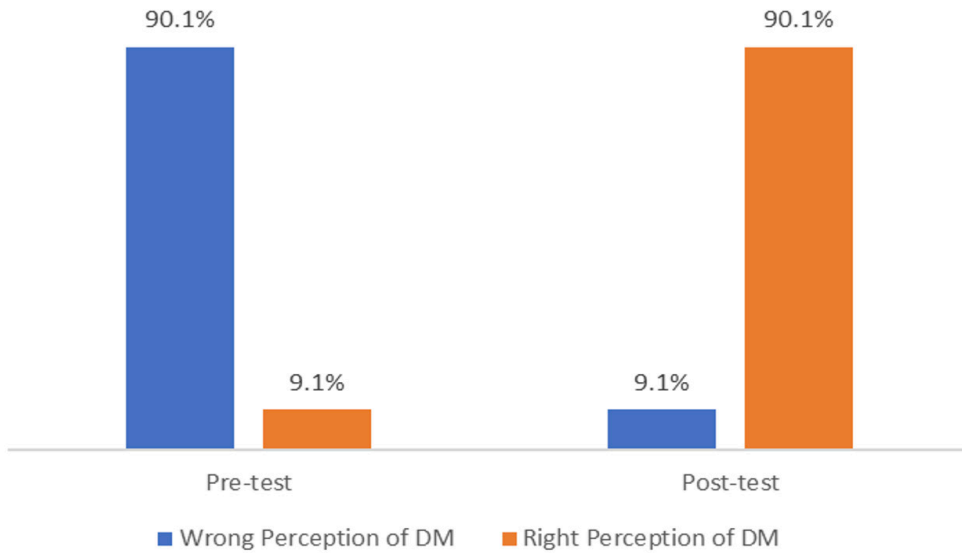


Figure 2: Perception of DM at pre-test and post-test among the trainers

Quantitative Assessment of Teachers' Perception at Baseline and Post-Intervention

According to Table 3, there was a significant increase in the mean perceived susceptibility at baseline (2.81±0.98) to 5.0±1.89 at post-test (p<0.05), mean perceived severity at baseline (1.27±0.44) to 3.54±1.36 at post-test (p<0.05), and mean perceived benefits at baseline (1.09±1.02) to 3.72±1.27 at post-test (p<0.05). The overall perception of DM shows there was an increase in perception of DM from 6.63±3.13 at pre-test to 16.45±4.48 at post-test (p<0.05). In Figure 2, most (90.1%) of the trainers exhibited a wrong perception of DM, while 9.1% exhibited

the right perception of DM at pre-test, and 90.1% exhibited the right perception of DM, while 9.1% exhibited a wrong perception of DM at post-test.

Quantitative Assessment of Teachers' Attitude at Baseline and Post-Intervention

In Table 4, there was a significant increase in the mean attitude towards DM at pre-test (7.54±3.26) to (13.27±4.47) at post-test (p<0.05). As shown in Figure 3, at baseline, 72.7% of respondents exhibited a negative attitude towards DM, while 27.3% exhibited a positive attitude towards DM, and at post-test, 81.8% of the trainers exhibited a positive attitude towards DM, while

Table 4: Attitude towards DM Prevention

Variable	Pre-test	Post-test	Z-Statistics	P-value
Attitude towards DM Prevention	7.54±3.26	13.27±4.47	-2.411	0.016

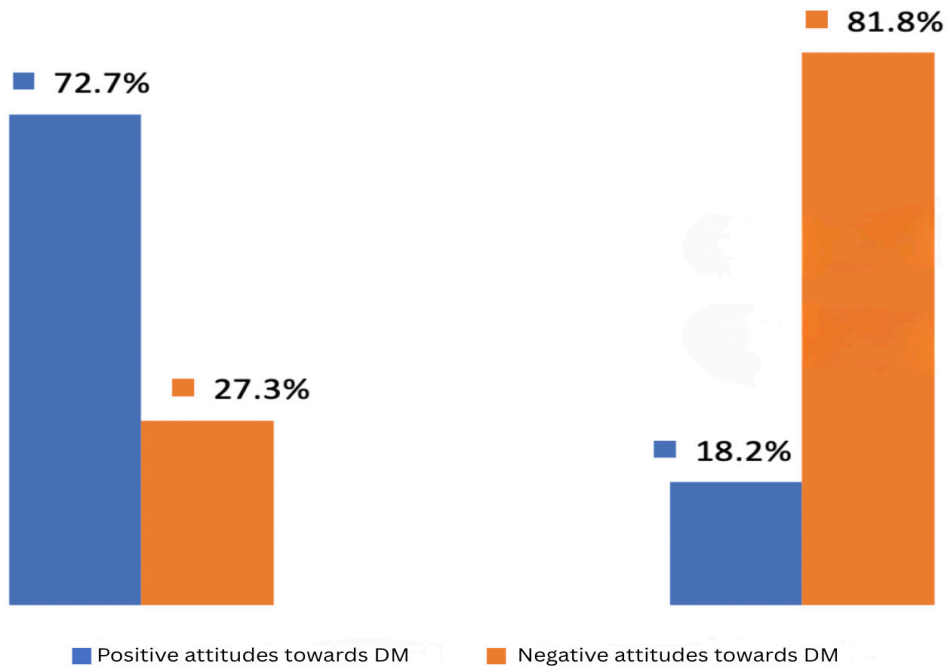


Figure 3: Attitude towards DM at pre-test and post-test among the trainers

18.2% exhibited a negative attitude towards DM.

DISCUSSION

The IDIs among teachers show that the majority of the teachers characterized DM as too much sugar in the blood. This shows hyperglycaemia is the best way people can recognize DM. This result was consistent with those of studies conducted in Ghana, Nigeria, and Turkey, where the majority of participants characterized DM as elevated blood sugar levels [22–24]. However, the World Health Organisation defined DM as a metabolic condition characterized by chronic hyperglycaemia brought on by abnormalities in insulin secretion, insulin action, or both [25]. This definition shows that none of the teachers were able to adequately define DM, which shows a knowledge gap at baseline. At post-intervention, most of the teachers demonstrated good knowledge of DM, and there was a significant increase in the mean knowledge of DM definition and types of DM. The finding was similar to the finding of a study that evaluated the impact of a Diabetes Education Curriculum for school personnel, which showed an improved basic knowledge of DM pre- and post-training [26,27].

The improvement in knowledge indicates that teachers now have a clearer understanding of the different forms of diabetes and their definitions. This foundational knowledge is critical for further learning and teaching. The teachers during the IDIs emphasised that consuming a lot of sugar, having a family history, and having insulin resistance were the main causes of diabetes mellitus. This result concurred with those of an earlier study conducted in Delta State [23,27]. The majority of the teachers showed good knowledge of DM causes after training. In addition, there was a significant increase in the mean knowledge of causes of DM at post-test. In the IDIs, frequent urination was the most mentioned symptom of DM. This was similar to a previous study where the teacher's mentioned polydipsia, polyuria and fatigue [22,28]. The teachers demonstrated good knowledge of post-test DM signs and symptoms, and there was a significant increase in the mean knowledge of DM signs and symptoms at post-test. This could be attributed to the training received by the teachers [26]. The improvement in recognising signs and symptoms is particularly important, as early detection can significantly impact patient outcomes. The risk factors listed by the teachers

during the IDIs include consuming food with high sugar content, high blood pressure, poor lifestyle, overweight and obesity. This result was comparable to that of a study in Ghana, where the teachers spoke of eating too many sweets and sugars, being overweight, having a family history of diabetes, and engaging in less physical activity [28]. At post-test, the teachers displayed good knowledge of DM risk factors and a significant increase in the mean knowledge of DM risk factors at post-test, which could be attributed to the training of the teachers. The notable increase in knowledge of risk factors suggests that educators are now better equipped to identify individuals at risk for DM, which is vital for prevention efforts. This finding was also similar to previous studies among teachers [28,29]. The findings of the IDIs showed some of the teachers demonstrated knowledge of complications of poorly managed DM. This result was consistent with one from a previous study where the respondents showed knowledge of DM complications [23]. As compared to the baseline, there was a significant increase in knowledge of DM complications, which could be attributed to the training of the teachers. This result was in agreement with findings from earlier research [23,28]. Some of the teachers demonstrated some form of knowledge of DM management. This result concurred with that of an earlier study conducted in Delta State [23]. The results were likewise consistent with those of a study conducted in Ethiopia, in which participants demonstrated some knowledge of DM [30]. Similar to the current study, teachers in a previous study also indicated some knowledge of DM management [31]. The increase in knowledge about complications and management strategies at post-test reflects a more comprehensive understanding of DM, empowering teachers to guide their students effectively in recognising and managing the condition. During the IDIs, some of the teachers displayed knowledge of DM prevention, with frequent physical activity, regular medical checkups, and healthy nutrition predominating in their responses. The results contrasted with those of a prior survey, which showed that respondents had little knowledge of DM prevention methods [32]. The variation in the findings between the two studies could be attributed to the study design and method of data collection. The teachers demonstrated good knowledge of DM prevention at post-test and a significant increase

in the mean knowledge of DM prevention, which could be attributed to the training of the teachers. The results were consistent with those from an earlier study [33]. The rise in knowledge about prevention is critical for fostering proactive health behaviours in both teachers and students. The teachers' overall comprehension of DM demonstrated that they had improved knowledge of DM at the post-test. The mean knowledge score of DM at post-test was greater than that at baseline, and the difference was significant. This might be attributable to the training acquired by the teachers. The conclusion was comparable to those of the findings of research in Jordan, where the study participants' knowledge scores greatly increased after the educational intervention [34]. Overall, there was an increase in knowledge at post-test because the intervention deliberately addressed myths and misconceptions, particularly spiritual interpretations of DM, which were evident in the qualitative findings. By confronting these beliefs directly, the training helped reshape teachers' understanding of causation, risk, and prevention. Additionally, incorporating local language expressions for DM likely enhanced comprehension and cultural relevance. Tailoring health messages to local idioms improves cognitive resonance and helps learners integrate biomedical concepts into existing knowledge structures.

The findings showed that teachers exhibited wrong susceptibility to DM complications at baseline. The finding of the study was similar to that of college students who exhibited wrong perceived susceptibility to DM [35]. This was contrary to the findings of another study where the respondents exhibited a right perceived susceptibility to DM complications [36]. This observed difference could be attributed to variation in study design and population. At post-intervention, the perceived susceptibility to DM of the teachers shows that the majority of the teachers displayed a right perceived susceptibility to DM. The finding is similar to a previous study where the teachers displayed a right perceived susceptibility to DM [36]. This result indicates not only a shift in awareness but also a growing understanding of the implications of DM and the importance of preventive measures. The teachers showed a wrong perception of the severity of DM complications. The results were consistent with those of a related study conducted in Port Harcourt, where more than half of the

respondents of that study had wrong perceptions of the severity of DM [37]. These also form part of the observed gaps at baseline of the study. Also, the teachers displayed the right perceived severity of DM complications at post-test. The results varied slightly from those of an earlier study [37].

Most of the teachers exhibited the right perceived benefits of DM prevention. Diabetes mellitus prevention helps in avoiding serious DM related health complications in the future, such as nerve, kidney, and heart damage. The results were consistent with those of an earlier study in which respondents had the right perceptions of the benefits of DM prevention programs [38]. In addition, the findings of the study at post-test showed that the majority of the teachers exhibited the right perceived benefits to DM prevention. This result also indicates not only a shift in awareness but also a growing understanding of the implications of DM and the importance of preventive measures. Teachers exhibited wrong perceived barriers to DM treatment. Knowledge of DM is vital to DM prevention [39]. The findings affirmed the improvement in perception of DM among the teachers at post-test; although the intervention improved most perception constructs, perceived barriers did not significantly change. This may be because perceived barriers such as cost of screening, limited clinic access, fear of diagnosis, cultural norms, or workload constraints are shaped by broader systemic and environmental factors rather than knowledge alone. Even with increased understanding, teachers may continue to perceive diabetes prevention as difficult if structural barriers remain unchanged.

Future interventions could incorporate problem-solving activities, community resource mapping, or policy advocacy components to more directly address these obstacles. The overall increase in the perception score signifies a substantial improvement in how teachers view DM. This comprehensive increase suggests that the intervention successfully provided a holistic understanding of the disease, covering its risks, management, and prevention. This was in line with the results of an earlier investigation [36]. The observed increase in perception could be attributed to the participatory workshop style created an interactive learning environment where teachers could engage actively with the material,

ask questions, clarify misconceptions, and practice applying new concepts. This aligns with adult-learning principles, which emphasise participatory, experience-based learning for better retention and behaviour change.

The study's findings indicated that teachers had a negative attitude toward DM prevention. The study's findings were in contrast with those of a prior study conducted in Ethiopia, when non-diabetic respondents showed positive attitudes toward DM [40]. Additionally, the results were in line with those of a survey conducted in Sri Lanka, where respondents had a negative opinion about DM [41]. The attitude towards DM prevention at post-test showed that the majority of the teachers exhibited a positive attitude towards DM prevention. This was greater than the pre-test attitude for DM prevention. The result was comparable to that of an earlier study, when the teachers' mean attitude score increased and was statistically significant at $p < 0.05$ [34]. Furthermore, there was an increase in the mean attitude post-test among the teachers, and the difference was statistically significant at $p < 0.05$. This finding agreed with those of an earlier study [34]. This shows the effect of the health educational intervention on the teachers.

The major limitation of the study was the small sample size of the teachers. However, this was stressed earlier that the teachers for the study were recruited as trainers in DM prevention in the community. Also, the study relied solely on the responses of the teachers at pre- and post-test. The strength of the study is that the study was the first in the study area to document the use of secondary school teachers as trainers in DM prevention in the study area.

The implications of the findings of the study are that the theory of task shifting is central to understanding why teachers responded so well to the intervention. Teachers occupy a respected social position in Nigerian rural communities, often functioning as informal advisers and role models. Their continuous interaction with young people and families positions them uniquely to act as change agents. Compared with community health workers, teachers are more consistently present in the community, have established communication networks, and possess teaching skills that facilitate structured information delivery.

However, task shifting also carries risks. Teachers are not medically trained, and expanding their roles without adequate supervision may lead to inadvertent misinformation, especially in complex areas such as treatment choices or glycaemic control. Sustaining accuracy requires ongoing monitoring, refresher training, and clear referral pathways to the formal health system. Integrating teacher-led health education into both the school curriculum and primary healthcare outreach could mitigate these risks. Collaboration between the ministries of health and education would be essential, enabling standardised training materials, certification, supervision, and opportunities for teachers to connect students with local health services. In terms of feasibility, this model is highly promising. Teachers are already embedded in communities, require no new infrastructure, and can integrate health education into existing school activities. The small group training approach used in this study is cost-effective and adaptable. Scalability will depend on establishing a standardised curriculum, training multiple facilitators, ensuring regular refresher programmes, and incorporating supportive supervision from local health workers. Embedding DM education within national teacher-training colleges could further institutionalise the model, ensuring sustainability.

CONCLUSION

The teachers demonstrated poor knowledge, perception, and attitude towards DM prevention at baseline. The teachers' knowledge, perception, and attitude, however, improved after the health educational training. The study outcome is that non-health personnel, like secondary school teachers, could be used for task shifting both within the school and the community. This will relieve the pressure usually faced by health personnel who are very busy in the hospitals and might not have the time to engage in DM prevention activities outside the health care settings.

REFERENCES

1. International Diabetes Federation Diabetes Atlas 8th Edition. IDF 2017. Available at: <http://www.diabetesatlas.org>. [Last accessed on 2024 April 2].
2. Uloko, A.E.; Musa, B.M.; Ramalan, M.A.; Gezawa, I.D.; Puepet, F.H.; Uloko, A.T.; Borodo, M.M.; Sada, K.B. Prevalence and Risk Factors for Diabetes Mellitus in Nigeria: A Systematic Review and Meta-Analysis. *Diabetes Therapy* 2018, 9, 1307–1316. doi:10.1007/s13300-018-0441-1.
3. Olatunbosun, S.T.; Ojo, P.O.; Fineberg, N.S.; Bella, A.F. Prevalence of Diabetes Mellitus and Impaired Glucose Tolerance in a Group of Urban Adults in Nigeria. *J Natl Med Assoc* 1998, 90, 293–301.
4. Oguoma, V.M.; Nwose, E.U.; Skinner, T.C.; Digban, K.A. Prevalence of Cardiovascular Disease Risk Factors among a Nigerian Adult Population: Relationship with Income Level and Accessibility to CVD Risks Screening. *BMC Public Health* 2015, 15, 397. <https://doi.org/10.1186/s12889-015-1709-2>.
5. Oshilonya, H.U.; Ijioma, S.N.; Ibeh, I.N. Prevalence of type-2 diabetes mellitus amongst suspected subjects in Agbor, Delta State, Nigeria and its relationship with age and gender. *Archives of Applied Science Research* 2015, 7, 18–20.
6. Ufuoma, C.; Ngozi, J.C.; Kester, A.D.; Godwin, Y. Prevalence and Risk Factors of Microalbuminuria among Type 2 Diabetes Mellitus: A Hospital-Based Study from, Warri, Nigeria. *Sahel Med J* 2016, 19, 16. doi:10.4103/1118-8561.181889.
7. Agofure, O.; Odjimogho, S.; Okandeji-Barry, O.R.; Efeberere, H.A.; Nathan, H.T. Pattern of diabetes mellitus-related complications and mortality rate: Implications for diabetes care in a low-resource setting. *Sahel Med J* 2020, 23, 206–10. DOI: 10.4103/smj.smj_64_19.
8. Agofure, O.; Okandeji-Barry, O.; Ogbon, P. Pattern of Diabetes Mellitus Complications and Co-Morbidities in Ughelli North Local Government Area, Delta State, Nigeria. *Niger J Basic Clin Sci* 2020, 17, 123. doi:10.4103/njbc.njbc_37_18.
9. Agofure, O.; Oyewole, O.E.; Igumbor, E.O.; Nwose, E.U. Diabetes Care in Delta State of Nigeria: An Expository Review. *Diabetes Updates* 2018, 5, doi:10.15761/DU.1000106.
10. Nwose, E.; Bwititi, P.; Oguoma, V. Cardiovascular Disease Risk Prevention: Preliminary Survey of Baseline Knowledge, Attitude and Practices of a Nigerian Rural Community. *North Am J Med Sci* 2014, 6, 466. doi:10.4103/1947-2714.141644.
11. Agofure, O.; Okandeji-Barry, R.O.; Okporu, U.C.; Agofure, K.; Oghenerume, H.; Dikenwonsi, A.; Abuh, I. Knowledge of diabetes mellitus: An aggregate qualitative study of students, teachers, market women, religious organization and community youths. *Ibom Med J* 2021, 14(2), 161–169.
12. Ojobi, J.E.; Odoh, G.; Aniekwensi, E.; Dunga, J. Mortality among Type 2 Diabetic In-Patients

- in a Nigerian Tertiary Hospital. *African Journal of Diabetes Medicine* 2016, 24(2).
13. World Health Organization; PEPFAR; UNAIDS Task Shifting: Rational Redistribution of Tasks among Health Workforce Teams: Global Recommendations and Guidelines. 2007, 88.
 14. World Health Organization. The State of the Health Workforce in the WHO African Region. World Health Organization; Brazzaville, Congo: 2021.
 15. Des Jarlais, D.C.; Lyles, C.; Crepaz, N.; the TREND Group Improving the Reporting Quality of Nonrandomized Evaluations of Behavioral and Public Health Interventions: The TREND Statement. *Am J Public Health* 2004, 94, 361–366, doi:10.2105/AJPH.94.3.361.
 16. Ofili, M.I.; Ncama, B.P.; Sartorius, B. Hypertension in Rural Communities in Delta State, Nigeria: Prevalence, Risk Factors and Barriers to Health Care. *Afr. J. Prim. Health Care Fam. Med.* 2015, 7, doi:10.4102/phcfm.v7i1.875.
 17. Agofure, O.; Oghenerume, H. Knowledge of Diabetes Mellitus among Students of a Public Secondary School in Southern Nigeria: A Cross-Sectional Study. *Student Journal of Health in Africa* 2022, 3, 3. DOI: <https://doi.org/10.51168/sjhrafrica.v3i3.108>.
 18. Otovwe, A.; Oritseje, E.-E.; Oghenerume, H. Applying the Health Belief Model on the Perception and Attitude towards Diabetes Mellitus among Public Secondary School Students in Southern Nigeria: A Cross-Sectional Study., *Student Journal of Health in Africa*, 2022.
 19. IDF Diabetes Atlas; Seventh edition.; International Diabetes Federation: Brussels, 2015; ISBN 978-2-930229-81-2.
 20. Nwose, E. "Uba"; Agofure, O. Training Handbook for Intensive Diabetes Peer-Education; LAP LAMBERT Academic Publishing: Mauritius, 2019; ISBN 978-613-9-45223-1.
 21. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. Available from: <http://www.wma.net/e/policy/pdf/17c.pdf>.
 22. Aycan, Z.; Önder, A.; Çetinkaya, S.; Bilgili, H.; Yıldırım, N.; Baş, V.N.; Peltek, H.N.; Sebahat, K.; Ağladioğlu, Y. Assessment of the Knowledge of Diabetes Mellitus Among School Teachers within the Scope of the Managing Diabetes at School Program. *Journal of Clinical Research Pediatric Endocrinology*, 2012, 4, 199–203, doi:10.4274/Jcrpe.756.
 23. Agofure, O.; Efeberere, A.H.; Odje, A.E. Knowledge of Dietary and Medical Management of Type-2 Diabetes in an Urban and Rural Community of Delta State Nigeria. *African Journal of Diabetes Medicine*, 2018, 26(1).
 24. Amissah, I.; Barnes, N.A.; Craymah, J.P.; Eliason, S. Knowledge of Diabetes Mellitus and Management Practices among Senior High School Teachers in Ghana. *IJSR* 2017, 6, 1090–1095, doi:10.21275/ART20163600.
 25. World Health Organization. Definition, Diagnosis and Classification of Diabetes Mellitus and Its Complications: Report of a WHO Consultation. Part 1, Diagnosis and Classification of Diabetes Mellitus. 1999.
 26. Smith, C.T.; Chen, A.M.H.; Plake, K.S.; Nash, C.L. Evaluation of the Impact of a Diabetes Education Curriculum for School Personnel on Disease Knowledge and Confidence in Caring for Students. *Journal of School Health* 2012, 82, 449–456, doi:10.1111/j.1746-1561.2012.00721.x.
 27. Agofure, O.; Okporu, U.C. Effects of Teacher-Led Educational Intervention on Knowledge and Attitude towards the Prevention of Diabetes Mellitus among Students of a Secondary School in Southern Nigeria: A Single Group Quasi-Experimental Study. *Rwanda MJ*, 2023, 80, 23–34, doi:10.4314/rmj.v80i2.3.
 28. Nabors, L.A.; Little, S.G.; Akin-Little, A.; Lobst, E.A. Teacher Knowledge of and Confidence in Meeting the Needs of Children with Chronic Medical Conditions: Pediatric Psychology's Contribution to Education. *Psychology in the schools* 2008, 45(3).
 29. Aljoudi, A.S.; Taha, A.Z.A. Knowledge of Diabetes Risk Factors and Preventive Measures among Attendees of a Primary Care Center in Eastern Saudi Arabia. *Annals of Saudi Medicine* 2009, 29, 15–19, doi:10.4103/0256-4947.51813.
 30. Senekal, M.; Seme, Z.; de Villiers, A.; Steyn, N.P. Health Status of Primary School Educators in Low Socio-Economic Areas in South Africa. *BMC Public Health* 2015, 15, 186, doi:10.1186/s12889-015-1531-x.
 31. Abdel Gawwad, E.S. Teacher's Knowledge, Attitudes and Management Practices about Diabetes Care in Riyadh's Schools. *J Egypt Public Health Assoc* 2008, 83, 205–222.
 32. Pardhan, S.; Raman, R.; Biswas, A.; Jaisankar, D.; Ahluwalia, S.; Sapkota, R. Knowledge, Attitude, and Practice of Diabetes in Patients with and without Sight-Threatening Diabetic Retinopathy from Two

- Secondary Eye Care Centres in India. *BMC Public Health* 2024, 24, 55, doi:10.1186/s12889-023-17371-3.
33. Chawla, S.P.S.; Kaur, S.; Bharti, A.; Garg, R.; Kaur, M.; Soin, D.; Ghosh, A.; Pal, R. Impact of Health Education on Knowledge, Attitude, Practices and Glycemic Control in Type 2 Diabetes Mellitus. *Journal of family medicine and primary care* 2019, 8, doi:10.4103/jfmpc.jfmpc_228_18.
34. Alsous, M.M.; Odeh, M.; Abdel Jalil, M. Effect of an Educational Intervention on Public Knowledge, Attitudes, and Intended Practices towards Diabetes Mellitus: A Quasi-Experimental Study. *Int J Clin Pract* 2020, 74, e13565, doi:10.1111/ijcp.13565.
35. Jones, C.G.; Lee, T.C.; López, I.A.; Citation, R.R.; Glenn, C. Perceived Susceptibility and Prevention Attitude of African-- American College Students'' Toward Type 2 Diabetes. *Florida Public Health Review* 2014, 11.
36. Morowaty Sharifabad, M.A.; Rouhani Tonekaboni, N. Perceived Severity and Susceptibility of Diabetes Complications and Its Relation to Self-Care Behaviors among Diabetic Patients. *Armaghane Danesh* 2007, 12, 59–68.
37. Onu, R.; Babatunde, S. Perceived Severity of Diabetes and Associated Factors among Patients Attending a Referral Hospital in Port Harcourt, Nigeria. *International Journal of Research in Medical Sciences* 2018, 6, 1856–1861, doi:10.18203/2320-6012.ijrms20181964.
38. Johnson, N.; Melton, S. Perceived Benefits and Barriers to the Diabetes Prevention Program. *PLAID* 2016, 2, doi:10.17125/plaid.2016.65.
39. Marian A, O.; Osuu Joy, I.- Knowledge, Attitudes and Practices of People with Type 2 Diabetes Mellitus in a Tertiary Health Care Centre, Umuahia, Nigeria. *J Diabetes Metab* 2012, 03, doi:10.4172/2155-6156.1000187.
40. Kassahun, C.W.; Mekonen, A.G. Knowledge, Attitude, Practices and Their Associated Factors towards Diabetes Mellitus among Non-Diabetes Community Members of Bale Zone Administrative Towns, South East Ethiopia. A Cross-Sectional Study. *PLoS One* 2017, 12, e0170040, doi:10.1371/journal.pone.0170040.
41. Herath, H.M.M.; Weerasinghe, N.P.; Dias, H.; Weeraratna, T.P. Knowledge, Attitude and Practice Related to Diabetes Mellitus among the General Public in Galle District in Southern Sri Lanka: A Pilot Study. *BMC Public Health* 2017, 17, 535. <https://doi.org/10.1186/s12889-017-4459-5>.