

AMERICAN UNIVERSITY OF BEIRUT

A PROTOCOL FOR A NURSE-LED SELF-CARE DIABETES
PROGRAM IN FEDERAL MEDICAL CENTER ABEOKUTA
OGUN STATE, NIGERIA BASED ON LESSONS LEARNED
FROM A SYSTEMATIC REVIEW OF LITERATURE

by
MOSUNMOLA AMINAT ABINA

A project
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Approved by:



Dr. Gladys Honein-AbouHaidar, Assistant Professor
Department of Nursing

First Reader



Dr. Nuhad Y. Dumit, Associate Professor
Department of Nursing

Second Reader

Date of project presentation: November 5, 2021

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ABSTRACT OF THE PROJECT OF

Abina Mosunmola Aminat for

Master of Nursing

Major: Nursing Science

Title: A Protocol for a Nurse-led Self-care Diabetes Program in Federal Medical Center Abeokuta Ogun State, Nigeria Based on Lessons Learned from a Systematic Review of Literature

Background:

Diabetes mellitus, known as Type 2 diabetes mellitus (T2DM), is a chronic metabolic disease characterized by high blood glucose level, when poorly managed, it can lead to various health complications. Globally, T2DM is the leading cause of death. In sub-Saharan African, the prevalence of diabetes has been rapidly increasing over the last decade. Self-care is a key element for the proper management and preventing complication. Nurses play a critical role in empowering patients to self-care for their disease. In Nigeria, my home country, the role of nurses in empowering diabetic patients to self-care for their disease is not well established, which can be considered as a predisposing factor influencing inadequate patient glycemic control and resulting in poor outcomes of care. This project is meant to shed the light on this gap. There are two parts for this project. The first part aims to conduct a systematic review to synthesize existing programs, strategies and interventions conducted in sub-Saharan countries for improving self-care among diabetes mellitus patients. The second part uses the findings of this systematic review to develop an evidence-based protocol for a nurse-led self-care diabetes program in the Federal Medical Center Abeokuta Ogun State, Nigeria.

Method:

The Donabedian theoretical framework was used to guide the systematic review and to build the protocol.

Part 1: Systematic review

We used a comprehensive search strategy with the help of librarian to identify eligible articles from different database engines including CINAHL (1983–2021); MEDLINE (1946–2021); and GLOBAL INDEX MEDICUS. Inclusion and exclusion criteria were clearly set to identify eligible studies reporting on programs targeting self-care empowerment strategies in sub-Sahara Africa (SSA). A rigorous screening and data retrieving method was implemented. Reporting of this systematic review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Results: A total of 2,479 abstracts and 307 full-text articles were assessed. Eighteen studies met the inclusion criteria. Based on the three domains of the Donabedian framework including structure, process and outcome, we found that in SSA most programs were led by a multidisciplinary health team under the leadership of physicians. The nurse-led programs were least documented where only one study was led by a diabetes specialist nurse in Ghana and two others by registered nurses in South Africa and Cameroon. In terms of the process, self-care approach was based mainly on education using group education sessions. One study used motivational behavioral modification approach. As for the outcomes, the following were used to measure the effectiveness of these programs: controlled HBA1C, blood pressure control, adherence to medication, diet and self-monitoring of blood glucose. Foot care had the least reported outcome, and most programs lacked follow-up. The diabetes specialist nurse led intervention was exceptional because of the strategy they adopted. The patients were guided by diabetes specialist nurses to set and evaluate personalized goals and plan actionable daily self-care activities in between clinic visits, thus reminding and facilitating the translation of self-care knowledge into practical living. The diabetes specialist nurse led the intervention focused on monitoring and modification in self-care practices.

Part 2: Protocol

The lessons learned from this systematic review enabled us to build our evidence-based protocol. Based on the Donabedian theoretical framework, we propose the following:

Structure: The clinic will be led by a nurse in coordination with a multidisciplinary addressing the different dimensional needs of the newly diagnosed T2DM patients A nurse-led clinic embedded in the endocrinology clinic at federal medical center Idi Aba Abeokuta

Process: The delivery of service will be based on an adapted practice guideline for self-care of newly diagnosed T2DM. The guideline needs to include the following three elements: education, motivation and follow-up.

To ensure adequate implementation, a training workshop will be conducted two weeks before the start of the clinic. In addition, the patient-encounter process will be clearly laid out. Instructions on the patient-nurse encounter include preparation in the pre-visit; during the encounter, and after the visit.

Outcomes: a monitoring and evaluation plan is proposed. The monitoring plan examines the fidelity, acceptance and feasibility of the protocol. The evaluation plan examines the output and outcomes of the nurse-led clinic.

Conclusion

This project synthesized programs focusing on self-care for diabetic patients in SSA. It also proposed a protocol for a nurse-led clinic to empower newly diagnosed T2DM patients to self-care for their disease.

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CHAPTER 1

INTRODUCTION

1.1 Epidemiological Facts

Diabetes is a chronic metabolic disease that is characterized by an increase in glucose level in the blood. Diabetes was the fifth leading cause of global deaths in 2019 (International Diabetes Federation, 2019; World Health Organisation, 2016; Wu et al., 2021). There are two diabetes types, type 1 and type 2 definition.

Type 1 diabetes is an autoimmune disorder in which the immune system attacks and destroys the insulin-producing beta cells in the pancreas. As a result, the pancreas produces little or no insulin (Cappuccio, 2014).

Type 2 Diabetes Mellitus (T2DM) is the most common type of diabetes accounting for >90% of the total number of cases and is the fifth leading cause of death for people aged 50–74 years. Globally, the prevalence of T2DM is on the rise, (Hicham El Berri, 2020; International Diabetes Federation, 2019; Price, Shandu, Dediccoat, Wilkinson, & Gill, 2011). The global prevalence of diabetes among adults aged 20 to 79 years was 8.1% in 2011 and rose to 9.3% (463 million people) in 2019 (International Diabetes Federation, 2019; Yu, Zhan, Yang, & Huang, 2021). This prevalence is anticipated to reach 10.2% (578 million) by 2030 and an astonishing 10.9% (700 million) by 2045. Reports indicate that T2DM patients have a 15% increased risk of pre-mature death and a reduction in life expectancy of about 20 years (International Diabetes Federation, 2019; Yu et al., 2021).

T2DM when uncontrolled has health, social, and psychological implications. Prolonged uncontrolled high blood glucose levels lead to damage to the heart, blood vessels, eyes, kidneys, and nerves leading to disability and premature death. It is the

leading cause of non-traumatic amputations, blindness, and end stage renal disease, and one of the principal causes of death from cardiovascular complications such as myocardial infarction. It doubles the risk of different types of cardiovascular diseases, such as coronary heart diseases and stroke. It is also associated with many non-vascular diseases such as cancer, mental and nervous system disorders, infections, and liver disease (Bos & Agyemang, 2013).

The risks of T2DM increases with age especially in both young and older adults from 20 years and above. Associated risk factors are obesity, family history of diabetes, eating habits, sedentary (Powers et al., 2015).

1.2. Background About Sub-Saharn Africa with Focus on Nigeria

Sub-Saharan Africa (SSA) is the region of the African continent located south of the Sahara Desert. According to the United Nations, it consists of 46 African countries that are fully or partially located south of the Sahara (United, Nation 2019). Data from the World Bank estimated the total population of people in SSA in 2019 to be 1.107 billion (The World bank 2019).The distribution of young to old adult population (18 - 65 years) in SSA was estimated to be 54.71% in 2019 (statista, 2021). In SSA, an estimated 15.5 million people were living with T2DM in 2017 and this number is expected to increase to 40.7 million by 2045.

Further, SSA has the highest proportion of pre-diabetes (69.2%) compared to high-income countries (Singh & Nichols, 2020). It has also been reported that over 90% of people in sub-Saharan Africa with diabetes have type 2 diabetes and less than 40% of those living with the condition maintain optimal glycemic control (Singh & Nichols,

2020). Approximately 6% of mortality in Africa is attributed to diabetes and the highest all-cause mortality due to diabetes occurs among individuals aged 30 to 39 years old.

Nigeria is the largest country with the highest population in SSA. As of 2021, its population amounts to over 210 million people and was estimated to constantly increase in the next decades (statista, 2021). The distribution of young to older adult population (15 -65 years over) in SSA was estimated to be 56.51% in 2020 (statista, 2021). Nigeria is the fourth country with the highest burden of diabetes with an estimated figure of over 1.7 million people living with the disease (Agofure, Oyewole, Igumbor, & Nwose, 2018; World Health Organisation, 2016). Further, Nigeria has the highest prevalence of diabetes in SSA, as reported by the International Diabetes Federation, diabetes Atlas of 2019. The prevalence of diabetes population between the ages of 20-79 years in SSA was 5.36%, whereas Nigeria accounts for 3.1% out of the total prevalence (International Diabetes Federation, 2019). The risk factors for the pooled prevalence of T2DM in Nigeria were family history of DM (4.6%); urban dwelling (6.0%); unhealthy dietary habits (8.0%); cigarette smoking (4.4%); older age (6.6%); physical inactivity (4.8); and obesity (5.3) (Uloko et al., 2018).

1.2.1. Background Information About the Clinic Settings

The Federal Medical Centre Abeokuta is in Abeokuta the capital city of Ogun state in Nigeria. The hospital is a 250-bedded regional specialist hospital which came into existence on 21st April 1993 with a philosophy of excellence in the provision of medical services to the gateway state and other neighboring states and nations.

However, over the recent years, the scope of this philosophy has gradually expanded to further encompass excellence in training and research, so that today, the hospital stands

on a tripod of excellence in research, training and health care service delivery. The hospital has over 50 specialists in various fields of Medicine. The hospital has recorded feats such as separation of Siamese twins, performing the very first trans-esophageal echocardiography in Nigeria and playing leading roles in several local and international collaborative research programs. The present medical director is Professor Musa Adewale Abdul-Samiu, who has been acting since 2017 till date.

Mission: “to provide prompt, excellent and cost-effective tertiary health care services to all her clients, build health care capacity for the sub-region and engage in research activities that significantly improve the health of Nigerians and contribute to the global fund of medical knowledge”

Vision: “ provide quality and timely clinical and other supportive services to patients within its jurisdiction in a milieu of qualitative research and training activities and becomes the first choice of seeking quality health care services in Ogun State and environs”.

The hospital has 24 clinical departments, 6 nonclinical departments, and 28 clinics (antenatal, cardiology , ENT, Ophthalmic, psychiatry, urology, neonatal, dermatology, endocrinology etc.), 56 consultants, over 400 nurses and 250 beds. It provides spectrum of services from routine and emergency diagnostic and therapeutic clinical services covering different specialties.

Through the Community Medicine and Primary Care (CMPC) Department the hospital regularly reaches out to different segments of the host Abeokuta community and the entire state to disseminate relevant health information and education through the mass media and community outreach programs.

The Endocrinology clinic is under the department of internal medicine and the consultant is Dr Adeshina Olubiyi F. The clinic was established in 2008 with the scope of current practices as delivery of care to diabetes patient.

1.2.2. Current Practice in the Hospital

The clinic is led by the doctor's team and other primary physician with the support of three register nurses and one dietician. Patients are managed in the traditional way; they are assessed physically on the clinic day by the nurses and referred to the consultants for consultation. The consultant assesses the patients based on the patient laboratory report or result and complaints, he prescribed or adjust medication and probably refer to the dietician when necessary. In the clinic, patients are not assessed individually, and the follow up is poor. Group education is not constant on every clinic day due to shortage of nurses and heavy workload on the nurses. Health education is mostly delivered by the dietician. The role and the impact of nurses are limited which indirectly affects the patient glycemic control. Presently, the hospital has no diabetes specialist nurse, but the nurses attended training and seminars where they are issued certificates most times.

1.2.3. Services

The clinic runs once a week, every Monday, they attend to approximately 70 diabetes patients per clinic day.

The clinic organized a diabetes support group that meet monthly to educate and counsel DM patients and address their worries and concerns.

Every November 14th is the world diabetes day, they plan and conduct a program for all DM patients.

The clinic manages and prescribe laboratory investigations for patients with endocrine and metabolic disorders such as hypothyroidism and hyperthyroidism. Additionally, the clinic as a WhatsApp group where they share information and tips on Diabetes care with all the patients.

1.2.4. Patient population

Patient from different part of the state attend the clinic, they have different socio-economic background with different level of education. Most of the patients are within the average age range of 18 - 60 years and above

1.2.5. Significance of the Project

The key to preventing T2DM is awareness, education, and health promotion of healthy lifestyle practices. For preventing the adverse outcomes of T2DM, it is critical to maintain optimal glycemic control. The latter to be achieved, patients need to be empowered to manage their disease through daily self-care behaviors. Self-care behaviors are long-life practices that require adherence, self-discipline and motivation. (American Diabetic Association (ADA), 2016). The American Diabetes Association (ADA) has defined a list of essential self-care behaviors that are positively correlated with optimal glycemic control and a reduction of complications. Those include self-monitoring of blood sugar level, diet management, physical activity, adherence to medications, and foot care. These constitutes the cornerstones of a self-care diabetes

program. Compliance to these self-care behaviors can alleviate complications from T2DM (Subramanian, Porkodi, & Akila, 2020).

Despite the importance of empowering diabetes patients to abide by those self-care behaviors, there is less emphasis on self-care in the management of diabetes (Price et al., 2011). This has been attributed largely to the complex nature of diabetes management, lack of adequate healthcare resources, and training in self-care empowerment, particularly in low middle-income country setting (Tewahido & Berhane, 2017). Often, physicians lead the management of patients with T2DM. Doctor-led management focuses more on the diagnosis and treatment of diseases and often there is less emphasis on telephone follow-ups, and health education, which leads to poor diabetes management outcomes (Godman et al., 2020).

Countries in SSA specifically have shortage or lack of dedicated personnel, lack of funding, poor monitoring systems, inadequate laboratory support and drugs (Pastakia Sonak 2015). Diabetes management guidelines and standardized assessments are often ignored with minimal empowerment for self-care. In addition, some few structured intervention programs that were initiated lack long term follow up (Rotheram-Borus et al., 2012). Possibly, because of these challenges, diabetes has a greater influence on morbidity and mortality related to the disease in SSA more than any other region in the world (Pastakia SD 2015).

In Nigeria, where I am intending to work as an Advanced Community Health Nurse, the existing health care system lacks policies and guidelines for the management of diabetes mellitus. During my clinical, personal observation from one health care facility in the western part of Nigeria in Ogun State bespoke shortage of nurses and thus the missing opportunity to have a dedicated diabetes specialist nurse. Nurses had

inadequate training in diabetes self-care and they had poor follow up of patients. Further, physicians focus majorly on the pharmaceutical aspect of the management and do not address the non-pharmaceutical aspect of managing the disease. As a result of this, poor glycemc control and it associated complications are reported in the Ogun State (Awotidebe, 2016). Thus, there is need for a nurse-led team to establish, anchor, and manage diabetes program because nurses make the largest workforce in healthcare and they spend more time with the patients as compared to the doctors.

1.2.6. Purpose of the Project

In order to highlight and strengthen the role and activities of nurses and eventually improve the outcome of care of T2DM, this project has two aims:

Aim 1- to conduct a systematic review of the literature to review all primary studies conducted in SSA countries to document their programs, strategies and interventions to improve self-care among diabetes mellitus patients.

Aim 2- to develop a protocol for a nurse-led self-care diabetes program for T2DM patient at Federal Medical center (FMC) Idi Aba Abeokuta

CHAPTER 2

METHOD

This study is composed of two parts ,the systematic review of literature and a protocol for a nurse led program at Federal medical center Idi Aba Abeokuta, Ogun State, Nigeria .The theoretical framework adopted for both are Donabedian framework of Structure-Process-Outcome .

2.1 Theoretical Framework

For both parts, we adopted the Donabedian Model as the guiding theoretical framework. The Donabedian framework of Structure-Process-Outcome (SPO) provides a framework for examining health services and evaluating quality of healthcare. It was used, to investigate, analyze and evaluate the effect and outcome of programs in healthcare organizations.

According to the Donabedian model, the quality of health care can be assessed by three components that are relevant for organizations: These qualities are **structure, process and outcome** (Donabedian, 2005). *Structure* is defined as the setting in which health care is provided (facilities, equipment, numbers, and qualification of personnel); *process*, as what is actually done in giving and receiving care (patient, nurses, doctors and other healthcare workers activities, communication between nurses and patients); and *outcome*, as the consequence of the provided health care (health status, satisfaction, and costs). Quality of health care is based on the interconnection of these three categories. As written by Donabedian: “A good structure increases the likelihood of good process, and good process increases the likelihood of good

outcomes”. The interaction between the categories can be bidirectional, and it is not a simple separation between cause and effect (Donabedian, 2005).

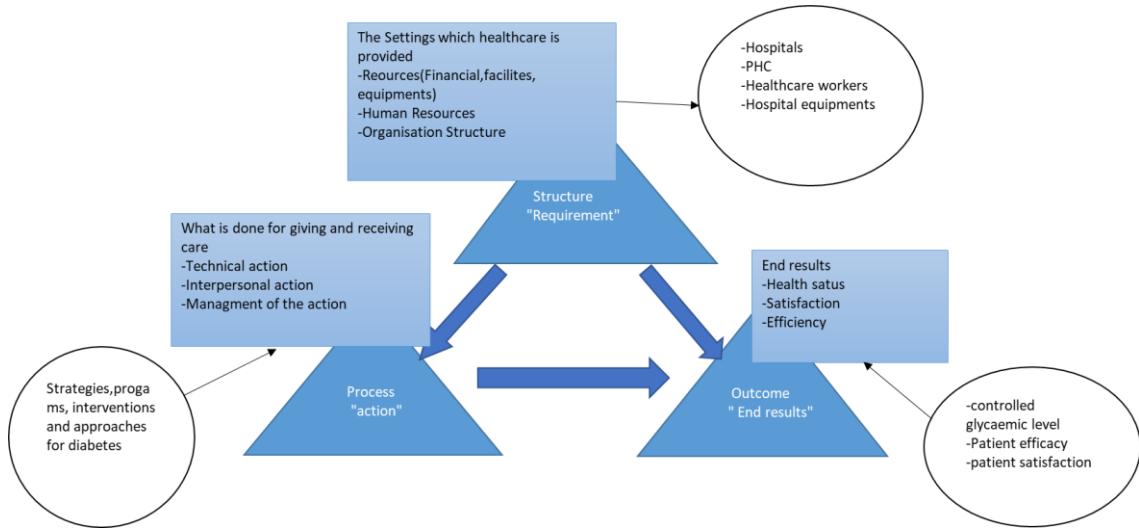


Figure 1: Donabedian framework: Adapted from evaluating the quality of medical care (Donabedian, 2005).

In this study, we used the Donabedian SPO framework to investigate the intervention and approaches to the self-care management of diabetes in healthcare institutions in SSA and to propose the protocol for the nurse-led protocol for the self-care of diabetes patients attending Federal Medical Center Idi Aba Abeokuta.

Structure: including settings, non-human and human resources. First, in terms of settings, healthcare facilities or organizations that provided or need to be housing the care. For example, tertiary, secondary or primary healthcare centers. The location is either urban, rural or peri-urban areas. Other resources including availability of laboratory facilities and equipment to run the test. The most important component of the structure were the healthcare workers involved in the delivery of services. Those included patients (diabetic patients, adults (ages 20 years and above), co-morbidities

(high blood pressure and obesity), physicians (endocrinologist), nurses (registered, manager), dietician/nutritionist, pharmacist and diabetic health educator.

Process: In the process, the types of programs, activities, approaches, and strategies implemented or planned to promote self-care. The programs include diabetes self-care management education (Diet, physical exercise, self-monitoring of blood glucose level, foot care and psychosocial wellbeing) and the formats are individual or group education, mobile phone call, peer support, training of healthcare workers. The documentation of the process includes forms (written or electronic) and content.

Outcome: In this project, the outcomes included controlled HBA1C (below or equals 7), controlled fasting blood sugar (100-130 mg/dl), controlled, blood pressure (130/90mmhg), reduced body mass index (2kg/m²) and compliance to positive health behavior and lifestyle modification (Diet, physical exercise, adherence to medication and Self-Monitoring of Blood Glucose (SMBG)).

2.2. Methods for The Systematic Review

2.2.1. Search Strategy and Screening Procedure

The terms for the search strategy were discussed with the medical librarian. Relevant articles were identified by searching: CINAHL (1983–2021); MEDLINE (1946–2021); GLOBAL INDEX MEDICUS (<https://www.globalindexmedicus.net/>)

This review was carried out according to the Cochrane Collaboration methodology (Higgins, Green, & Higgins, 2013), incorporating the recommended quality features for conducting SRs of reviews (Barnaby C Reeves), and is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses PRISMA statement (Moher, Liberati, Tetzlaff, Altman, & null, 2009). Searches were

supplemented by hand searching and retrieval of any additional articles meeting eligibility criteria that were cited in reference lists. The search of all published studies was performed in June/July 2021.

2.2.2. Inclusion Criteria

Published studies fulfilling the following criteria were included: (i) Type of study, all study type of both qualitative and quantitative design; (ii) Types of interventions, studies that involved self-care management of type 2 diabetes, diabetes self-management approaches by healthcare workers, diabetes self-management policies and guidelines; (iii) Types of participants, studies that involved type 2 diabetes patient; and (iv) content, studies conducted in SSA.

2.2.3. Exclusion Criteria

Exclusion criteria included (i) studies about type 1 diabetes mellitus or other chronic disease; (ii) studies not conducted in SSA; (iii) studies not available in English; (iv) unpublished studies or non-peer reviewed; and (v) studies conducted outside SSA.

2.2.4. Data Extraction, Analysis and Synthesis

A data extraction template was developed using a Microsoft template to gather all the relevant data for analysis. The data extraction sheet was used to collect the characteristics of the included studies including year and country of publication, number of participants, type of intervention programs, results, discussion and conclusion. Information about the quality of the included studies were derived from the text using quality-assessment tools for cross-sectional studies, pre-post studies and randomized

controlled trials adapted from the National Heart, Lung and Blood Institute (NIH) (National Heart and lung, year). In the appendix, you can find the full details of the PRISMA checklist for this review and the full risk assessment of the included studies therein.

2.3. Method for the Protocol

The lessons learned from this systematic review enabled us to build our evidence-based protocol. Based on the Donabedian theoretical framework, we identified the following:

Structure:

Setting: the clinic housing the activity.

Team of professionals: healthcare workers involved in the delivery of services including patients.

Other resources including laboratory facilities and equipment to run the test.

Process:

Protocol for diabetes self-care to include education, self-monitoring behaviors, motivational interviewing approaches. We adapted the practice guidelines of the American Diabetes Association.

Training of nurses and team of professionals on the protocol.

Process of the care delivery: instructions on preparation during the pre-visit; the interaction with the patient during the visit (education, motivation) and post-visit interventions: after visit summary, phone calls.

Format of education: individual or group.

Documentation of the process including forms (written or electronic) and content.

Outcome:

Outcomes of care: HBA1C (below or equals 7), fasting blood sugar (100-130 mg/dl), blood pressure (130/90mmhg), body mass index (2kg/m²) and compliance to positive health behavior and lifestyle modification (Diet, physical exercise, adherence to medication and Self-Monitoring of Blood Glucose (SMBG)).

Monitoring of the delivery of services including fidelity to the process of care, documentation of services, in addition to acceptability and feasibility challenges.

Add chapter concluding remarks or statements and transition to next chapter

CHAPTER 3

RESULTS

This chapter report the results from the systematic review according to Donabedian framework.

Part 1: Systematic review

3.1 Characteristics of The Included Studies

In total, the search-strategy provided 2,950 articles (MEDLINE 2249, CINAHL 616, GLOBAL INDEX MEDICUS 85). After adding the total results to ENDNOTE, 293 duplicates were automatically removed, and the remaining articles yielded 2,657. We manually removed 178 duplicates. In summation, 471 duplicated articles were removed. The overall publications left for tittle and abstract screening were two, 479 articles. After the second level of screening of full text, the final yield was eighteen studies that met the eligibility criteria. Figure2 (PRISMA FLOW CHART) illustrate the search yield and the selection process. The reasons for excluding some the articles were because they discussed type 1 diabetes mellitus and other issues other than diabetes self-care management and approaches. Also, some of the articles were not published in Sub Saharan Africa countries. Additionally, study protocols, unpublished articles and non-peer reviewed were also reasons for exclusion.

The publication dates were between 2009 and 2021 despite including studies from inception. Majority of the articles (n=16) were published after 2010.

3.2. Screening

A research assistant, an undergraduate student nurse, and myself independently reviewed the titles, keywords and the abstract .We both discussed the eligibility for the full text inclusion. Discrepancies were discussed among the reviewers to come to terms with an agreement. After discussing and coming to terms with the screening, we were left with 309 articles for full text screening. The full text of the remaining publications was screened for eligibility using the inclusion and exclusion criteria, 291 articles were removed because they did not discuss interventions or programs for T2DM, were not conducted in SSA, not published in English and discussed diabetes type 1 only and other chronic diseases.

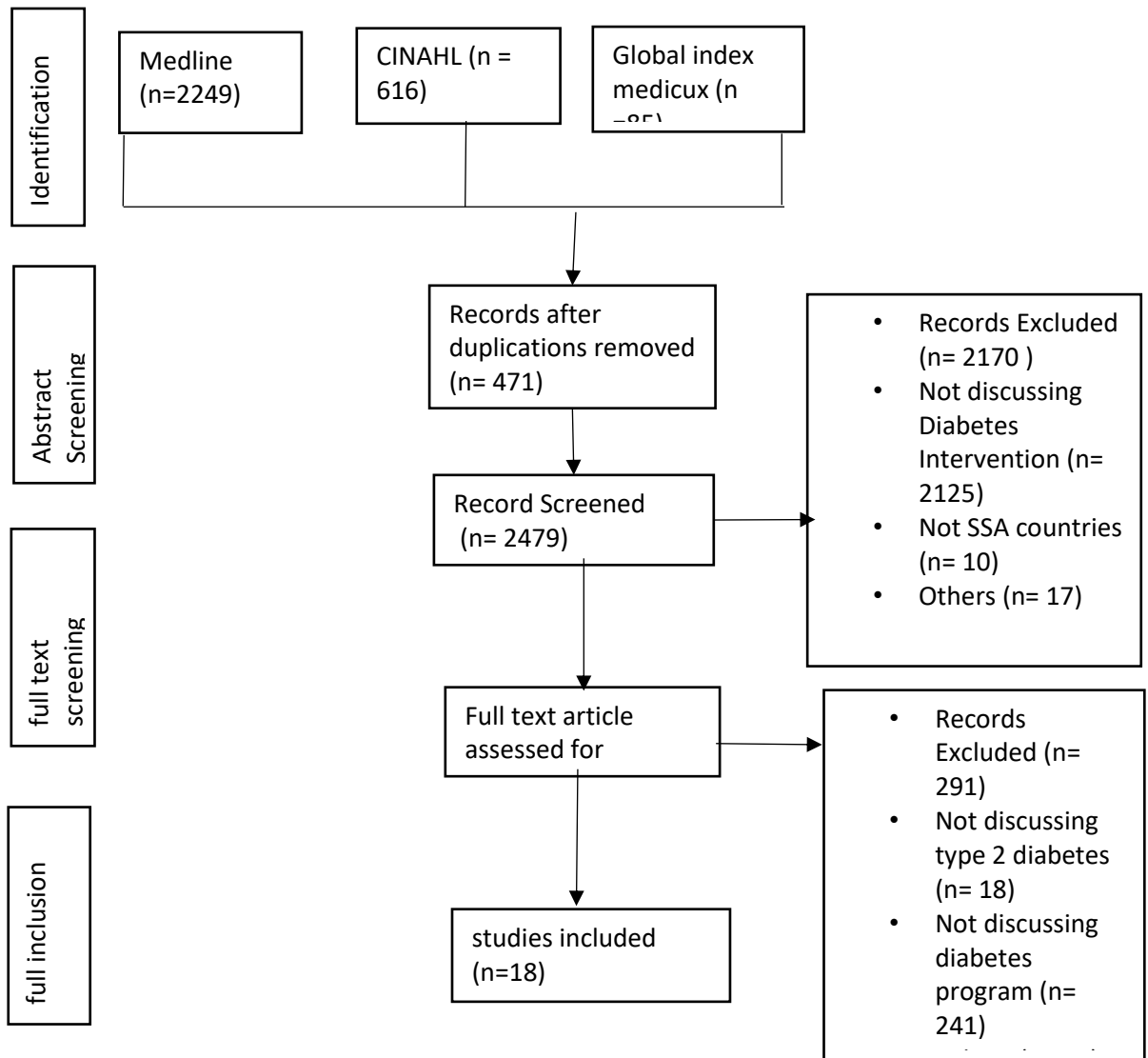


Figure 2: Prisma flow chart for literature search and the selection process

3.3. Results

3.3.1 Study characteristics

Five of the studies were from South Africa, Four from Kenya, three from Cameroon and two from Nigeria. Ghana, Rwanda and Zimbabwe have one each, while Malawi and South Africa published together one study.

Regarding the study design, six studies were randomized control trials (RCTs) (Amendezo et al., 2017; Asante et al., 2020; Gathu, Shabani, Kunyiha, & Ratansi, 2018; Leon et al., 2021; Mash et al., 2014; Muchiri, Gericke, & Rheeder, 2016); three experimental (Afemikhe & Chipps, 2015; Muhoma, Waruiru, Sanni, Knecht, & McFarland, 2020); and six were cross sectional observational studies (Baumann, Frederick, Betty, Josphine, & Agatha, 2015; Kengne et al., 2009; Kolawole et al., 2008; Nkomani, Ruskaniko, & Blaauw, 2021; Pastakia Sonak 2015; Price et al., 2011). One of the studies is a non RCTs (Assah, Atanga, Enoru, Sobngwi, & Mbanya, 2015) while the other two remaining studies are implementation (Rotheram-Borus et al., 2012) and mixed studies (van der Does & Mash, 2013).

Table 1 Showing the programs and outcome

	Author	Year	Country	Study Settings	Healthcare Settings	Led by	Study Type	Sample Size	Strategies / interventions / Approaches				Outcome								
									Mobil e Phone	peer supporter	DSM E	Trainin g of HCWs	Controlled A1C	FB S	SMB G	Medicatio n Adherence	Die t	B P	Footcar e	BM I	Physical Activitie s
1	Enerst	2020	Ghana	Urban	Hospital	Diabetes specialist Nurse	RCTS	60	x				x			x					
2	Afemikhe and Chipps	2015	Nigeria	Urban	Hospital	Multidisciplinary Health team	Quasi-experimental	28	x		x	x		x				x		x	
3	Amendezo Etienne	2017	Rwanda	Urban	Hospital	Multidisciplinary Health team	RCTS	251			x	x	x								
4	Assah	2015	Cameroon	Urban	Hospital	peer supporters	Non-RCTS	98		x	x	x	x	x							
5	Linda	2014	Uganda	Rural	PHC	peer supporters	pre -post quasi experimental	60		x	x		x				x	x			
6	Catherine	2018	Kenya	Urban	Hospital	Family physician and Diabetic Educator	RCTS	220			x		x								
7	kolawole	2009	Nigeria	Urban	Hospital	Multidisciplinary Health team and diabetic educator	Cross-sectional	150			x			x		x					
8	Natalie	2021	Malawi and South Africa	urban and peri urban	Hospital and PHC	Multidisciplinary Health team	RCTS	89	x		x					x					
9	Mash	2014	South Africa	Rural	PHC	Health promoters	RCTS	1057			x							x			
10	Muchiri	2015	South Africa	Rural	PHC	Registered Dietician	RCTS	82			x						x				x
11	Nkomani,	2019	Zimbabwe	Urban and Rural	Hospital and PHC	Registered Dietician and diabetic Educator	Cross-sectional	154			x						x				x
12	Muhoma	2020	Kenya	Rural	PHC	Multidisciplinary Health team	Quasi Experimental	78			x									x	
13	Pastakia	2015	Kenya	Urban and Rural	Hospital and PHC	Multidisciplinary Health team	Observational	137	x		x		x		x						
14	PRICE	2011	South Africa	Rural	PHC	Nurses	Observational	80			x		x								x
15	Albertine	2013	Cameroon	Rural	PHC	Multidisciplinary Health team	Mixed Methods	84			x						x			x	x
16	Wambui	2015	Kenya	Urban and Rural	Hospital	Diabetic Educator and Clinician	Retrospective observational cohort	164			x		x		x						
17	Kengne	2009	Cameroon	Urban and Rural	Hospital	Nurse	observational	225				x		x				x			x
18	Rotheram-Borus	2012	South Africa	Rural	PHC	Nurses and peer supporters	Implementation	22	x	x	x	x	x		x		x	x		x	x

3.4. Strategies and Interventions for Self-Care of Diabetes Mellitus

3.4.1. Structural Characteristics of the Self-Care Programs

Studies conducted in the rural areas were seven (Baumann et al., 2015; Muchiri et al., 2016; Muhoma et al., 2020; Price et al., 2011; Rotheram-Borus et al., 2012; van der Does & Mash, 2013) and six in urban areas (Afemikhe & Chipps, 2015; Amendezo et al., 2017; Asante et al., 2020; Assah et al., 2015; Gathu et al., 2018; Kolawole et al., 2008). While studies conducted in both rural and urban were five (Kengne et al., 2009; Leon et al., 2021; Nkomani et al., 2021; Pastakia Sonak 2015; Wambui Charity et al., 2016).

The study settings in this review are primary hospitals and tertiary hospitals (Afemikhe & Chipps, 2015; Asante et al., 2020), teaching hospitals (Assah et al., 2015; Kolawole et al., 2008), family medicine clinics (Gathu et al., 2018) and community health centers in the urban area. Others are local PHCs (Amendezo et al., 2017; Baumann et al., 2015; Price et al., 2011), community health centers (Muhoma et al., 2020), primary clinic (Rotheram-Borus et al., 2012; van der Does & Mash, 2013), tertiary and clinic hospital (Kengne et al., 2009; Leon et al., 2021; Pastakia Sonak 2015), all based in the rural areas.

Regarding those who led the interventions, seven were led by multidisciplinary healthcare teams (Afemikhe & Chipps, 2015; Amendezo et al., 2017; Kolawole et al., 2008; Leon et al., 2021; Muhoma et al., 2020; Pastakia Sonak 2015; van der Does & Mash, 2013). Four studies were led by diabetic educators and physicians (Nkomani et al., 2021; van der Does & Mash, 2013; Wambui Charity et al., 2016). Only one study was led by a diabetes specialist nurse (Asante et al., 2020), two by a registered nurses (Kengne et al., 2009; Price et al., 2011) and one was conducted jointly by registered

nurses (Rotheram-Borus et al., 2012) and peer supporter. Two of the studies were solely led by peer supporters and supervised by nurses and physicians (Assah et al., 2015; Baumann et al., 2015). Health promoters (Mash et al., 2014) and registered dietician (Muchiri et al., 2016) led one study each.

The equipment used for assessment of the patients in the clinic were sphygmomanometer for measuring the blood pressure, weighing scale and glucometer for checking patient blood glucose (Kengne et al., 2009). Further, some resources and materials such as educational materials were used in training the HCWs and the patients (Mash et al., 2014). Examples are educational materials on nutrition (Muchiri et al., 2016). Some of the patients were given educational pamphlets, patient guide to diabetes booklet and graphic material on self-care activities at the end of the session to complement the education session (Gathu et al., 2018). Another material was a diabetic diary where the interventionists recorded their call date, time, duration, personalized self-management goals, action plans, and self-management challenges (Asante et al., 2020). To ensure follow up, some patients were provided with mobile phones linked to a prepaid network so that calls could be made at no cost (Baumann et al., 2015). Other materials included were handbook and clinical algorithm for patient diagnosis, education and treatment (Kengne et al., 2009).

Human resources that led and coordinated the programs were registered dieticians that focused majorly on nutritional education (Muchiri et al., 2016; Nkomani et al., 2021). Health promoters were recruited from the district health services and were trained for to deliver education session within the facility (Mash et al., 2014). The Family physicians gave consultation to the diabetes patients on clinic days (Gathu et al., 2018) while the certified diabetes educator gave individualized structured DSME

training. Additionally, the multidisciplinary team were made up of physician, nurses, dietitians and medical social workers led most of the diabetes program (Kolawole et al., 2008; Mash et al., 2014; Muhoma et al., 2020; Nkomani et al., 2021; Wambui Charity et al., 2016). However, there was only one diabetes specialist nurse that led a diabetes clinic and anchored the programs for diabetes patients (Asante et al., 2020). More so, some community health centers recruited some peer supporters. The supporters were diabetes patient that have maintained good glycemic control over years, and successfully managed the condition (Baumann et al., 2015; Pastakia Sonak 2015; Wambui Charity et al., 2016). They were trained by doctors and nurses on DSME (healthy eating, being active, taking medications, monitoring blood sugar, problem solving, reducing risks, and problem solving), communication skills, effective group and face-to-face meetings, and use of personal history as examples in peer support (Assah et al., 2015). Lastly, is the combination of registered nurses and peer supporters, the registered nurses led the team and trained the community supporters and some primary health care nurses to deliver the program (Kengne et al., 2009; Pastakia Sonak 2015; Price et al., 2011; Rotheram-Borus et al., 2012).

3.4.2. Process Characteristics of Self-Care Programs

A total number of 3,038 participants were included in all the studies with an average age of 45 years above. The guidelines adopted for the programs were from the American Association of Diabetes Educators (AADE) self-care behaviors (Gathu et al., 2018), Zakhe diabetes education flip chart (adapted with modification) and the South African food-based dietary guidelines flip chart to teach the content on diabetes and the dietary guidelines (Muchiri et al., 2016). A study from Kenya used the Kenya Diabetes

Management Information Centre (KDMIC), Kenya National Diabetes Educators Manual (KNDEM), and the World Diabetes Foundation (Muhoma et al., 2020) while a study from Nigeria used International Diabetes Federation (IDF) education training manual for sub-Saharan Africa (Kolawole et al., 2008).

Sixteen studies used diabetes self-care management education (DSME) approach; and eight of the studies combined other approaches (such as mobile phone, peer support and training of healthcare workers) with DSME. Only two studies adopted mobile phone approach and training of health of HCWs with DSME (Afemikhe & Chipps, 2015; Asante et al., 2020).

The most widely used approach was DSME (Kengne et al., 2009; Kolawole et al., 2008; Price et al., 2011). The education focused mostly on understanding diabetes, living a healthy lifestyle, understanding the medication and avoiding complications (Mash et al., 2014). Also included in the DSME was regular physical activity, cessation of smoking and alcohol abuse, and regular medical follow up, treatment and screening for diabetes complication, self-management of hypoglycemia and hyperglycemia and stress management (Gathu et al., 2018; van der Does & Mash, 2013). In addition, nutrition education (NE) program was included in the DSME, the NE consisted of three components: curriculum (eight weekly sessions, 2 to 2.5 h), follow-up sessions (four monthly meetings and two bi-monthly meetings each lasting 1.5 h); and vegetable gardening (demonstration of sowing/transplantation of vegetables) (Muchiri et al., 2016).

Some programs trained the providers (registered nurses, PHC nurses, peer supporters, health promoters etc.) to update their knowledge on practice and recommendations on diabetes care. They also trained the patients on DSME prior to the

implementation of the program (Amendezo et al., 2017; Mash et al., 2014; van der Does & Mash, 2013). An example is a one-day workshop held by the nurses at the diabetic clinic with the aim of refreshing patients' knowledge on the complications of diabetes as well as their self-management skills in terms of diet, exercise, foot care, medication taking, blood glucose monitoring, and management of hypoglycemia (Assah et al., 2015).

Mobile phone intervention was mostly used to follow up on patients, question them their daily health and lifestyle and send supportive text messages to patients (Rotheram-Borus et al., 2012). Furthermore, the combination of SMBG and mobile phone call was another intervention used (Wambui Charity et al., 2016). Patients were instructed to perform at least two daily blood glucose checks—a fasting blood glucose test before breakfast and before dinner prior to administering insulin and eating. Patients were required to record their blood glucose readings in diabetes diaries and report their results to the call center via verbal phone calls on a weekly basis. This phone-based system was designed to minimize the number of times patients had to be physically present in the clinic, incur transportation, and encounter costs. During each weekly phone call, patients were asked to provide the time and date of all glucose results, the doses of all diabetes-related medications, any changes in diet, and any subjective symptoms of hypo- or hyperglycemia. After collating weekly patient results, trained diabetes clinicians reviewed patient charts and advised on the appropriate dosage adjustments based on standardized protocols. Patients were then called back with the recommended dosage adjustments.

Lastly, was peer support intervention, patients were peered with supporters in close location to monitor them, encourage, give moral, psychological and social support (Assah et al., 2015; Baumann et al., 2015).

The interventions were implemented via group education, individual education, and mobile phone call. For some, group patients' education was given educational pamphlets to complement the education session (Mash et al., 2014; Muchiri et al., 2016; van der Does & Mash, 2013). Also, the peer support intervention was implemented through group meetings (held in close location to each peer supporters and the members) and personal encounters (between peer supporters and their group members, and telephone calls). Skills used were communication skills, effective group and face-to-face meetings, and use of personal history as examples in peer support (Assah et al., 2015). Additionally, some institutions used multiple interventions such as DSME program, which comprises group discussions, individual counselling, multimedia teaching, motivational interviewing, telephone calls and goal-setting charts for feedback.

Individualized structured DSME training was delivered through behavioral assessment, goal-setting and problem-solving to promote autonomous self-regulation for better health and quality of life. The education session was on monthly basis with the individual education session lasting an average of 50 minutes while that of the group education lasted 1-2 hours.

Evidence from the review revealed that only few studies followed up on patients. Follow up was weekly on the mobile phone with mean duration of 12 minutes and patient received a reminder via a telephone call few days to their appointment (Gathu et al., 2018; Rotheram-Borus et al., 2012).

3.4.3. Outcomes of Self-Care Programs

Overall, the program outcomes were controlled HbA1C, improved fasting blood glucose, reduction in both diastolic and systolic blood pressure, reduced BMI and improved self-care activities. Evaluation for most of the programs were done at six, twelve and eighteen months respectively.

Controlled HBA1C was the most documented outcome recorded in nine studies (Amendezo et al., 2017; Asante et al., 2020; Assah et al., 2015; Baumann et al., 2015; Gathu et al., 2018; Kengne et al., 2009; Pastakia Sonak 2015; Price et al., 2011; Rotheram-Borus et al., 2012). This was followed by dietary modification (Baumann et al., 2015; Muchiri et al., 2016; Nkomani et al., 2021), self-monitoring of blood glucose (SMBG) (Afemikhe & Chipps, 2015; Kolawole et al., 2008) and reduction in blood pressure (BP) reported in five studies (Afemikhe & Chipps, 2015; Kengne et al., 2009; Price et al., 2011; Wambui Charity et al., 2016).

Interventional outcome on body mass index (BMI) (Afemikhe & Chipps, 2015; Kengne et al., 2009; Price et al., 2011; Rotheram-Borus et al., 2012) and physical exercise were recorded in four studies each (Muchiri et al., 2016; Nkomani et al., 2021; Rotheram-Borus et al., 2012; van der Does & Mash, 2013). Three studies documented adherence to medication (Asante et al., 2020; Kolawole et al., 2008; Leon et al., 2021), while foot care (Muhoma et al., 2020; van der Does & Mash, 2013) was the least recorded and found in two studies.

The study analysis revealed that DSME was effective in reducing the HbA1c from 9.8% to 8.8% in the intervention arm (mean difference: -0.98, SD: 2.29) and 9.9% to 9.3% in the control arm (mean difference: -0.60, SD: 1.59) (Asante et al., 2020). Another notable event was a significant improvement in adherence to diabetic diet,

physical activity, foot care and the perceived ability to teach others (Muchiri et al., 2016; Nkomani et al., 2021).

There was a significant decrease in both systolic and diastolic blood pressure in the intervention group (Mash et al., 2014). Nutritional education showed a reduction in the intake of starchy and energy food and a slightly but significant reduction in HbA1c levels by 0.64 % at 6 months and 0.63 % at 12 months (Baumann, Frederick, Betty, Josephine, & Agatha, 2015; Nkomani, Ruskaniko, & Blaauw, 2021; Rotheram-Borus et al., 2012). This slight reduction maybe of clinical importance in reducing the risk of diabetes-related complications (Muchiri et al., 2016). There was reduction in smoking from 25% -18% but no report on adherence to medication (van der Does & Mash, 2013). Other outcomes were changes in self-reported adherence to medication and diabetes self-management measures over the 12-week period (Asante et al., 2020).

The peer group intervention improved psychosocial aspects of the participants (Rotheram-Borus et al., 2012). The programs resulted in reduction of uncontrolled blood sugar. The outcome of the process measures and participants' satisfaction from the diabetes specialist nurse led intervention was beyond authors' expectations. After the 12-week post-intervention period, the intervention group had their mean A1C level improving, whereas that of the control group worsened. The secondary outcomes were changes in self-reported adherence to medication and diabetes self-management measures over the 12-week period (Asante et al., 2020)

Part 2: Protocol

The proposed protocol is divided into three (3) based on the structure, process and outcome of Donabedian Model and guided by the findings from the systematic

review of the literature. This protocol will target newly diagnosed patients because it is a proposed pilot program, it will be able to train and monitor and effectively guide the patients towards self-care activities to prevent diabetes related complication.

3.5. Goals and objectives

3.5.1. Goals

A. To establish a nurse led diabetes program for newly diagnosed T2DM patients in Federal Medical center Idi Aba Abeokuta.

B. To improve nurses' knowledge on approaches to empower self-care behaviors among T2DM patients in Federal Medical center Idi Aba Abeokuta.

Objectives and strategies

3.5.1.1. Structure

Objective 1: To get approval from the Federal Medical center Idi Aba Abeokuta to use the premise of the clinic for conducting the nurse-led clinic and to make use of the other resources in the hospital such as health care professionals, laboratory, radiology and other specialists three months before the launch of the clinic.

Strategies for objective 1

- Write a letter to the Medical Director to introduce the proposal, its rationale and potential benefit
- Explain in the letter that referral to other resources in the hospital will be needed and hence permission to waive the fees for those additional services.

- Ask permission to designate two nurses currently working in the hospital to be assigned to the nurse-led clinic and freeing their time to work with the advanced community health nurse to coordinate the services
- Facilitate access to specialists when needed.

Objective 2: Identify the registered nurses and the other healthcare professionals that will make up the team of the diabetes nurse led clinic eight weeks prior to the establishment of the clinic

Strategies for objective 2

- Once permission from the hospital administration is granted, plan and organize a general meeting for the nurses and involved healthcare professionals at the federal medical center by sending an email invitation
- Request for peer volunteers to participate in the nurse-led clinic. Those individuals newly diagnosed with T2DM are outspoken and are willing to support other patients during the peer education sessions.

Objective 3: Map all other resources that are needed to provide comprehensive care to patients.

Strategies for objective 3

- Locate the laboratory tests available at the medical center
- Locate the radiology tests available at the medical center
- Identify the list of specialists that will be potentially involved in the comprehensive care of patients
- Get the equipment needed for the clinic

3.5.1.2. Process

Objective 4: Adopt and adapt an algorithm for managing newly diagnosed T2DM patients.

Strategies for objective 4.

- For this nurse-led clinic, we adopted and adapted the algorithm for the medical management of newly diagnosed T2DM patients from the 2018 Canadian Diabetes Association guidelines. Discuss with the endocrinologist the algorithm for final approval and adoption.

Objective 5: Prepare the materials for empowering patients with education on healthy behaviors.

Strategies for objective 5.

- List the targeted healthy behaviors: physical activity, smoking, nutritional management, and weight control.
- Prepare printed materials/slides targeting each of those healthy behaviors
- Identify videos and other audio-visual materials to share with patients on those healthy behaviors

Objective 6: conduct a training targeting nurses working in the clinic on the approaches for empowering patients with self-management skills to control their diseases two weeks prior to the launch of the clinic

Strategies for objective 6.

- Prepare the training materials on self-care support for patients
- Set the timetable for a two-day workshop to train nurses and the health care team on self-care support.

- Set the date, time and venue for the workshop and invite speakers for the workshop.
- Prepare checklist and other forms to be used in self-care support
- Prepare the pre- and post-the level of comprehension of the workshop attendants

Objective 7: Delineate the different approaches to be used while encountering patients in the clinic.

Strategies for objective 6.

- Provide prescriptive instructions on the preparation before the patient visit (pre-visit planning)
- Describe the flow of care during the patient visit:
 - Assessment
 - Physician encounter
 - Post-visit summary
 - One on one education. The plan needs to include self-care education and lifestyle interventions (SMBG, physical exercise, glucose tracking using Mobile app, foot care, diet and adherence to medication)
 - Referral if needed
- Provide different approaches for follow-up:
 - Phone calls
 - Mobile apps
 - Group education
 - Peer support

3.5.2.3. Outcomes

Patients

Objective 8: To achieve and maintain a good glycemic control (HA1C below or equals 7mgldly, FBS 100-130mg/dl) among 75% of the newly diagnosed T2DM patient after 1 month, 3 months, 6 months and 1 year.

Strategies

- Patient will visit the clinic at least once in a month
- Direct patients to community resources where they can find blood glucose testing machines after the first encounter
- Provide a form where patients can register their DSM each day during the first encounter
- Monitor the control of blood glucose levels over time.

Objective 9: To attain 90% comprehension of what is diabetes, its risk factors, the normal level of glycemic control, the signs and symptoms of hypo or hyperglycemia and appropriate channels for seeking help among the newly diagnosed T2DM patient after 6 months from their first visit to the clinic.

Strategies

- Patient clearly articulates the blood glucose levels indicating a low, normal and high recording
- Patient reports the signs and symptoms of hypoglycemic/hyperglycemia.
- Patients are aware of the process of dealing with hypoglycemia and hyperglycemia at home
- Patients are aware on the conditions to reach out to the diabetic nurse

Objective 10: To attain 50% of targeted lifestyle modifications including person-centered nutritional intake, smoking control and physical activity among the newly diagnosed T2DM patient after 6 months from their first visit to the clinic and one year after.

Strategies

- Patients followed up via mobile phone call on biweekly to check on their compliance to medications and lifestyle behavior modifications
- Patients report adherence to diet and medication
- Patients report having daily physical activity

A. Nurses

Objective 11: To attain 85% fidelity to the implementation of the processes of care.

Strategies

- All health care team clearly understood the program protocol, goals and objectives
- The two registered nurses effectively plan, manage and coordinate the diabetes program in the clinic in collaboration with other healthcare professionals

3.6. Program Indicators

3.6.1. Nurses:

- 90% of the registered nurses effectively planned, managed and coordinated the diabetes program in the clinic.
- 90% of the nurses will attend the workshop, 80% of the nurses will demonstrate increased knowledge and competence in DSME within two weeks of the training.

3.6.2. Patients

- 90% of the patient will attend group and individualized education session
- 90% of the patient will participate actively in their self-care activities
- 60% of the patient will perform self-glucose monitoring at home
- 60% of patient will have a logbook and document their blood glucose value daily
- 60% will report utilizing the mobile app tracker daily
- 60% of the patient will adhere to prescribed medication ,diet and physical exercise
- 90% of the patient will be followed up via mobile phone call(once a week) and text messages(twice a week)
- 70% Patient will maintain a normal range of HBA1C(less than or equal 7%), FBS(70–130 mg/dl (3.9–7.2 mmol/l), blood pressure(130/80mmhg)
- 80% of the patient will undergo screening for retinopathy, neuropathy and foot examination at 6month and subsequently yearly.

3.6.3. Expected Outcome

- Improvement in the knowledge of nurses on DSME, improvement in the care and service given to patients
- Improvement in patient self-care behavior activities (compliance to diet , adherence to medication, physical exercise and foot care)
- Patient turn-up and attendance of group and individual education session
- Patient utilization of mobile app blood glucose tracker
- Mobile phone call and text message follow-up by the nurses

- Improved HBA1C, FBS, RBS, diastolic and systolic blood pressure
- Number of patients screened for retinopathy, neuropathy and foot examination at 12months

3.6.4. Evaluation Methods

- Pretest and posttests for the nurses before and after the training
- Pretest and Posttest for the patients before the group education and at six months
- Observation: do the nurses apply the training on patient education in the care and management of the patients.
- Patient record: checking patients record or charts to assess nurses documentation and approaches used for each patients e.g. documentation on patient education, motivational approaches as per the chart.
- Oral interview with the patient about their self-care activities and the services provided in the clinic

3.6.5 Timeline for Program Evaluation

The program will be evaluated at 6 months, 12 months and at 18months respectively.

3.6.6 Communication of Findings

Findings from the program evaluation will be reported to the to the nurses and other professional team and recommendations will be made based on the result.

3.6.7. Evaluation Question for Program Indicators

Nurses

Does the training increase the knowledge of nurses on DSME as evidenced by their practice in the care and management of diabetes patient?

Patients

- Do patients demonstrate positive behavioral change of self-care activities in terms of compliance to diet, adherence to medication, physical exercise and foot care?
- Do patients show to their appointment by attending group and individual education sessions?
- Were patients able to utilize the mobile app for tracking and keeping record of blood glucose, blood pressure and weight?
- Do nurses follow up on patients using mobile phone call and text messages?
- Were there improvements in HBA1C, FBS, RBS, diastolic and systolic blood pressure and BMI?
- Were preventive routine screening for retinopathy, neuropathy and foot examination at 12 months done?

3.7. Implementation Plan

The algorithm of the protocol for management of T2DM patients is the following:

- At the time of diagnosis of type 2 diabetes, healthy behaviour interventions should be initiated. This is new preferred term over

“lifestyle modification”. These include nutritional therapy, weight management, and physical activity.

- This is also an option to start metformin.
- If the A1C is less than 1.5% above the patient’s target A1C, if they are not at glycemic target within 3 months of healthy behaviour interventions, metformin should be started or increased.
- If the A1C is greater than or equal to 1.5% above target A1C, metformin should be started immediately. A second concurrent antihyperglycemic agent should be considered.
- If the patient has symptomatic hyperglycemia and/or metabolic decompensation, insulin should be initiated alone or in combination with metformin. This includes patients with dehydration, diabetic ketoacidosis or hyperosmolar hyperglycemic state.
- If the patient remains not at glycemic target, the first question to ask in choosing the second antihyperglycemic agent is whether the patient has clinical cardiovascular disease. Clinical cardiovascular disease is defined as history of myocardial infarction, coronary artery disease on angiography, unstable angina, stroke, peripheral artery disease)
- If the patient has clinical cardiovascular disease, an antihyperglycemic agent with demonstrated CV benefit should be added. This recommendation is based on several cardiovascular safety outcome studies.

- For people with clinical cardiovascular disease not reaching glycemic target OR for people without clinical cardiovascular not at target, the next antihyperglycemic agent should be selected best suited to the individual based on a variety of clinical considerations.
- For many patients, avoidance of hypoglycemia and/or weight gain with adequate glycemic efficacy are important considerations. For these patients, an appropriate choice of agent includes a DPP-4 inhibitor, GLP-1 receptor agonist or SGLT2 inhibitor.
- For other groups of patients, other considerations may be important.

These may include:

- Reduced eGFR and/or albuminuria
- Clinical CVD or CV risk factors
- Degree of hyperglycemia
- Other comorbidities (CHF, hepatic disease)
- Planning pregnancy
- Cost/coverage
- Patient preference

3.7.1. Human Resources for the Proposed Protocol

We propose to have a designated advanced community health nurse (ACHN) for the newly diagnosed diabetic patients to empower patients to self-care for their disease. A nurse led diabetes clinic (NLDC) can be a cost effective and efficient way to improve patient outcomes (Suresh K Sharma & Kalpana Thakur, 2020).

The ACHN will collaborate with the existing team including:

- a. Hospital administrator
- b. Registered Nurses (2)
- c. Endocrinologist/ primary care physician
- d. Pharmacist
- e. Laboratory scientist/technician
- f. Social worker
- g. Psychologist
- h. Medical record officer
- i. Patients (newly diagnosed type 2 diabetes patient)

3.7.2. Job Description

3.7.2.1. Advanced Community Practice Nurse

- Organize and conduct training for the registered nurses on DSME
- Supervising and coordinating the activities of the two registered nurses
- Coordinating services with other professionals
- Assessing and monitoring patient records
- Consult with specialist regularly to report observations and suggest possible solutions
- Work with hospital stakeholders to develop and implement local guidelines
- Work with stakeholders to develop a culture of patient-centred care and development.
- Promoting evidence-based practice and cost-effectiveness regarding prevention, treatment and management of diabetes
- Initiate and lead research through leadership and consultancy.

- Identify service shortfalls in the provision of adequate diabetes care and develop strategies with the professional team to address them.
- Identify the need for change, proactively generate practice innovations, and lead new practice and service redesign solutions to better meet the needs of patients and the service.

Overall, the advanced community practice nurse will lead the team, supervise, coordinate and provide training, education and support to other registered nurses. Additionally, she will collaborate with other healthcare team and consult with the endocrinologist in complex and complicated cases. The registered nurses in particular play a clinical role in screening, maintaining and supporting people with diabetes.

3.7.2.2. Registered Nurse 1 (RN1) will:

- Recruit the patient during their first visit or from the medical record database. Then the RN will assess the patient general health and wellbeing through history taking (past and present medical conditions, signs and symptoms, family history, nutrition/diet etc.) and observe patient vital signs (BP, weight, height). RN also examines the eye and foot for retinopathy and neuropathy and document all finding.
- Review the laboratory results ,interpret, diagnose and make referrals when necessary.
- Develop and ensure delivery of educational materials, supportive networks and models of diabetes care that foster empowerment and lifelong learning about diabetes.

- Provide tailored, structured education and support to optimize self-care skills and promote informed decision-making about lifestyle choices.
- Introduce patient to mobile application (my fitness pal) use for daily monitoring and self-assessment.
- Allocate patient to appointment day and date for follow-up care.
- Organize and plan awareness and screening activities for patient and the community at large.

3.7.2.3. Registered Nurse 2 (RN 2)

- Provide information and support to encourage diabetes patient to make informed choices about controlling and monitoring their diabetes, including choice of treatment and follow-up; risk reduction; monitoring control; and complications.
- Identify psychosocial barriers to self-care and refer on where necessary.
- Facilitate the development of an individualized and agreed care plan.
- Work with diabetes patient to facilitate lifestyle adjustment in response to changes in their diabetes or circumstances
- Follow-up with patients via mobile phone call, text messages and sending reminders for appointment.
- In summary, the roles and responsibilities of the nursing team relating to diabetes care include prevention advice, using behavior change and health coaching techniques, screening, prevention and early detection of type 2 diabetes, promoting self-care, mental health awareness, nutrition, blood glucose monitoring, injectable therapies (if and when necessary), identifying and treating hypoglycemia and hyperglycemia

3.7.3. Equipment and materials needed in the clinic

General health assessment and screening for complications are one of the major components of diabetes care, so it is imperative to have the equipment to do this. It is important to be equipped with the following:

- a. Weighing scales and height measure-to calculate body mass index. .
- b. Digital blood pressure, heart rate, oxygen machine.
- c. A blood glucose meter with strips and lancets to measure blood glucose. This is a short-term one-point test to identify blood glucose level– for example to identify hypoglycemia.
- d. Sharps boxes for the safe disposal of sharps equipment.
- e. Educational materials on diabetes and self-care activities (flyers, posters and pamphlets).
- f. Documents for keeping patients records and to track and monitor their progress e.g., goal setting and goal agreements, diabetes self-care management education checklist and questionnaire.
- g. Two private rooms, one for consultation; another for education.
- h. A meeting room for conducting the training

3.8. Process

First part: Training of registered nurses

A two-day workshop will be organized for nurses on prevention, treatment and diagnosis of type 2 diabetes, training on DSME skills and approaches. This workshop is aimed at improving knowledge of nurses in diabetes self-care management

education and for each of the nurses to know what is expected of them in the program.

Therefore, the workshop will focus on the below:

- Discussion on diabetes, causes, signs and symptoms, diagnosis and complication.
- The role of nurses in DSME (education, counselling, motivation, adopting self-care management tools, setting goals, monitoring and follow-up).
- The importance of documents to be used for the program (DSM goal, goal agreement, DSM questionnaire and Checklist), when and how to use them.
- Essential laboratory investigation and their importance including:
 - HbA1c (glycosylated hemoglobin),
 - U&E (urea & electrolytes),
 - LFT(liver function tests),
 - TFT (thyroid function tests),
 - Lipids (to assess the cholesterol levels and breakdown of the cholesterol such as Total cholesterol, LDL, Triglycerides, HDL and non-HDL levels to help reduce the risk of CVD), and
 - FBC (full blood count) to screen for any conditions such as anemias, which can interrupt the HbA1c results and can cause nephropathy).
- Self-care management activities such as diet, medication, physical exercise, footcare, self-monitoring of blood glucose.
- Recognition, treatment and management of hypoglycemia and hyperglycemia
- Identifying and managing psychosocial issues.
- Introduce the mobile app concept and mobile phone call and how to how to implement it.

3.8.1. Materials Needed for the Training Sessions

- a. Program goals and objectives
- b. Patient diabetes self-care management education content (Patient education manual)
- c. DSME questionnaire and checklist
- d. Goal setting and goal agreement checklist

3.8.2. Second Part: Diabetes Self-Care Program

The strategies that will be adopted for this program are patient assessment, group and individual education and counselling on diabetes self-care management activities, mobile application glucose tracking, self-monitoring of blood glucose and mobile follow up.

The target population for this program are type 2 diabetes patient receiving care at Federal Medical Center Endocrinology Clinic.

Eligibility criteria: are patients newly diagnosed with type 2 diabetes from 18 years and above with or without comorbidities. They may attend the clinic from any part of the state (rural, urban or suburban).

Recruitment: Patients will be recruited by checking diabetes patient records from the medical record. Demography information like medical record number (MRN), phone number, address, age, gender, occupation and educational status. Additional information includes patient diagnosis (date of diagnosis), morbidity, comorbidity, treatment and treatment.

Before the visit: Each patient that meets the eligibility criteria will be given informed consent about the program via phone or email. Thereafter, those that agreed to participate will be given appointment for group education session and consultation with the endocrinologist.

During the visit: Assessment and physical examination will be conducted.

History taking of onset of the disease, signs and symptoms, drugs taken, type of diet, past medical history and family history.

Assessment: measuring blood pressure (BP), heart rate, heights and weights (for calculating body mass index). Urine and blood test for urinalysis and blood sugar level respectively. Other laboratory test includes HBA1C, fasting blood glucose ,random blood glucose, urea and creatinine and Lipids.

Before the medical consultation:

General group education (appendix 11) and individual education (appendix 11) will be given to patients. Group education (covering all aspects of diabetes self-care activities) will be held during the first visit, and then subsequent appointment will be personal education session, lasting minimum of 40 minutes.

Individual education session

The one-on-one session involving the nurse and the patient lasting minimum of 40 minutes. The nurse will use the skills acquired during the training to assess, listen, motivate and encourage the patient. If the patient desires and feels he needs assistance and support, one of his family members or close friends accompany him. Involvement of family members in patients care has been reported to have a positive effect (reference).

A minimum number of six (6) patients will be attending to on each clinic day. During the personal education session, patient will be educated using the DSME

checklist and blood sugar control progress will be assessed using the mobile app and laboratory results. In this session, patient self-care motivation will be encouraged, and psychosocial issues will be addressed. Below are the process and activities for the individual education session:

- The first registered nurse will receive the patient into the clinic and check the vital signs, she will also check patient diary or logbook to check improvement in blood glucose level and check the mobile app for progress. She orders and prescribes labs (FBS, RBS, HBA1C and others). She then transfers the patient to the second nurse for continuity of care.
- The second registered nurse takes up the patient, she makes the patient comfortable and allows him or her to freely express himself/herself by verbalizing his/her challenges, worries and concerns.
- The nurse will use the diabetes self-management questionnaire (Check Appendix) to assess the patient's self-care activities from the last clinic attendance until present. The questionnaire will identify areas that the patient is lacking and that need concentration.
- Based on the questionnaire, the patient will set goals using the diabetes self-care management goal (Check Appendix?). The patient and the nurse then agree on areas to work on using the goal agreement (Check Appendix?).
- The nurse will give a detailed education and explanation on the identified areas. She will use her communication skills along with posters and audio-visual aids when necessary. They both plan on the activities to achieve the set goals.
- She will make referrals to specialists when needed e.g., dietician, pharmacist, endocrinologist.

- The nurse will follow-up on the patient via mobile phone call once a week and send text messages on alternate days.
- She documents her findings for reference and evaluation purpose.
- She will fix next clinic appointment and send reminders a day to the scheduled appointment.

3.9. Targeted Values for Diabetes Control for this Program

The targeted patient values include the following based on the Canadian Association Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada (2013):

- HBA1C < 7.0%
- FBS 4-7mmol/L
- RBS 5-8 mmol/L
- BP <130/80
- LDL-C < 2.0mmol/L

CHAPTER 4

STUDY DISCUSSION

This project is the first systematic review in Nigeria and in SSA that discussed nurses and other healthcare professional roles in intervention programs and approaches for self-care for T2DM patient.

The structured programs adopted by most healthcare institutions was diabetic self-care management education (DSME) approach using the guideline from American diabetes association educator. A study from Nigeria used International Diabetes Federation education training manual for sub-Saharan Africa (Amendezo et al., 2017; Kolawole et al., 2008; Mash et al., 2014). This education program focuses primarily on self-care activities such as nutrition, medication adherence, SMBG, physical exercise and foot care. From these lists of activities, footcare was the least implemented and patient education was mostly by group education, which lasted for an average of 1-2 hours on monthly bases. Most of the healthcare institutions gave pamphlets and fliers to these patients on self-care activities to reinforce learning. Before implementing the interventions, most health organizations organized training session for the healthcare workers to update their knowledge on diabetes self-care activities.

Another method of intervention noticed was the mHealth, nurses and the peer supporter put a call through to their patients as a follow up. Also, some PHCs recruited peer supporters from the community, some of them were diabetes patient that have maintained good glycemic control over years, and they have successfully managed the condition. Doctors and nurses trained the supporters on DSME. The peer supporters had a regular encounter with the patients since they live in the same community which made it easy for them to provide the need support and encouragement (Baumann et al., 2015;

Gathu et al., 2018). Some adopted home SMBG, patients were instructed on how and when to access the blood glucose and they record the value of the blood glucose in a book or send as a message or phone call to the health provider to report the value (Assah et al., 2015; Baumann et al., 2015). Most of these programs are similar to diabetes program in Nigeria except for the mHealth and peer support. These two approaches will be of great benefit if implemented in Nigeria and other SSA countries because it creates a convenient medium ensuring guidance, patient motivation and continuity of care. Financially, it is cheap to implement because all most all the patients have a mobile phone, and the method is a usual phone call text message, which does not require a high technological skill. Additionally, mHealth will reduce stress and cost of transportation to the clinic. It can also be a source of support in healthcare centers which are short of manpower or staffs. Study by Liang et al from China on effect of mobile phone intervention for diabetes on glycaemic control reported strong evidence that mobile phone intervention led to statistically significant improvement in glycaemia control and self-management in diabetes care, especially for Type 2 diabetes patients (Liang et al., 2011). From this review, few studies ensure follow up; those that followed up (Leon et al., 2021; Rotheram-Borus et al., 2012) on the patients recorded a good outcome. It is crucial and of great importance to follow up on diabetes program and individual to have a good outcome of care. Only one study considers the psychological and social aspects of management (Assah et al., 2015). Many studies have recorded stress and burden associated with diabetes management. This should be addressed when managing diabetes patient because psychosocial state inversely affects patient participation and outcome of care.

For the program implementation, different healthcare teams were involved, majorly multidisciplinary healthcare team, which is composed of primary physician, clinician, registered nurses, diabetic educators and registered dietician .Other personnel were peer supporters and health promoters, no study mentioned laboratory scientist/technician and pharmacist. These two specialists cannot be left out in the management of diabetes patient. Reasons for not involving them may be because some of the primary health care centers cannot afford the charges attracted to the service. Nurses were the least represented in the program implementation. For the multidisciplinary approach, the doctors majorly did consultation with the diabetes patient and focusing mainly on medication and referred them to the nutritionist or diabetes educator when needed. The multidisciplinary approach yielded a more positive result, this would not have been possible without the effort of the nurses. The registered nurses personalized the care for each patient, and they followed up with a telephone call (Kolawole et al., 2008).This implies that nurse's role cannot be underrated in multidisciplinary health team.

Diabetes educators were mostly in charge of the DSME sessions. They included all self-care activities in the education program and focused mainly on behavioral assessment, goal-setting and problem-solving to promote autonomous self-regulation for better health and quality of life (Gathu et al., 2018). Individualized DSME by the diabetic educator did not improve the glycemc and metabolic control of the sub-optimally controlled type 2 diabetes patients. A critical insight into the situation revealed that the usual care offers self-management education and support for patients but mainly at the clinic site. Practically, patients' self-management and adherence take

place in between clinic visits. However, the usual care lacks continued patient follow-up.

Dieticians anchored the education session on diet and physical exercise including that of foot care (Gathu et al., 2018; Muchiri et al., 2016; Wambui Charity et al., 2016). The program led by the health promoters and registered dietician, showed no remarkable reduction in the HbA1C and BMI. However, there was a significant improvement in the blood pressure and positive attitude towards diet. This could be because the nutritional program was customized to patients' needs using locally available foods. Considering culture when planning and implementing programs can increase the success rate. Another factor can be that less qualified mid-level healthcare workers were unable to deliver the intervention effectively. They did not demonstrate sufficient skills and were not fully consistent in their use of the guiding styles.

The peer support led intervention was successful because of the interaction between the peer supporters and the champions. This intervention has proved to **promote psychosocial support for people with diabetes** especially in the poor resource area and with people that financially burdened (Assah et al., 2015). It reduced the cost of visiting the clinic, and still received good care and guidance for the peer support. It also reduces stress on the path of the healthcare workers because the telephone call serves means of tracking and monitoring the progress of each patient and the peer supporters are there to give update to the HCWs in case of any critical or emergency. The peer supporters gave continuous care to the diabetes patient. The community-based peer support for diabetes care significantly improves glycemic and metabolic control above and beyond usual clinical care (Baumann et al., 2015). This was supported by a study conducted in Indonesia on community peer based support health life style

program (CP-HELP) stating, “CP-HELP is a promising interventional strategy to improve self-care behavior and improving fasting blood glucose in patient with T2DM”

Following the result from this review, nurses were not well represented in the diabetes program, yet their impact was outstanding in the few ones they participated. The intervention led by the diabetes specialist nurse had a great and a remarkable impact on the glycemic level and self-care behaviors of the diabetes patients (Asante et al., 2020). This improvement can be attributed to the mobile phone call follow up made to the patients each week. In addition, the specialist nurses set and evaluate personalized goals and plan actionable daily self-care activities in between clinic visits, thus reminding and facilitating the translation of self-care knowledge into practical living. Moreover, the nurses at the PHC were able to manage patients using treatment algorithm and followed up on patient that missed scheduled visit. The primary healthcare program for diabetes implemented by nurses achieved significant positive outcomes in term of blood glucose, blood pressure and weight control. From this report , it can be deduced that the role of nurses is vital and cannot be underrated in healthcare organizations because, they spend most time with patients ,they know their needs, weaknesses , challenges and possible solutions to improve and promote health. In international countries, roles, impact and outcome of nurses has been document in self-care management for diabetes patients. Two studies conducted in India and China supported this with evidence that nurse led intervention treatment and management has resulted in an impact of practical significance on T2D self-management, and was beneficial for controlling the level of HbA1c. They also reported recovery of self-management and self-efficacy as well as reduction in fasting blood sugar and

postprandial blood sugar among patients with Type 2 DM (Subramanian, Porkodi, & Akila, 2020; Zhihua Guo et al., 2019).

The outcome from the intervention programs in this review were primarily improving HBA1c, fasting blood sugar, SMBG, medication adherence, blood pressure, diet, foot care, BMI and improved physical activities. There need to focus on foot care intervention to prevent associated complication. Overall, the programs were effective, cost efficient and accepted by the affected population, hospital staffs and the community. Nevertheless, governments need to provide these services at a subsidized rate. As, it was reported in some studies, that they provided blood glucose monitor and strips to the patients free of charge and some provided mobile phone airtime and subscription, this could be some of the factors that contributed to the resounding outcome that was notice.

4.1. Recommendations

Findings from this review revealed that the multidisciplinary approach was mostly implemented. Nurse's major roles was taking the baseline measurements, they were rarely involved in the main plan and implementation of programs. Also, there was only one diabetes nurse specialist, and this nurse was not reported to be an advanced practice nurse. It important for nurses to upgrade their education through advancement in nursing education as this will keep them abreast and improve their standard of practice alongside other professionals. One of the major problems to adherence in self-care activities among diabetes patients is lack of follow up leading to empowerment in self-care practices. It is therefore recommended that diabetes care and education specialists could spend few minutes during the working hours to reach out to their

patients weekly or monthly to assess and support their self-management in between visits. This follow-up may increase their workload, but the advantages far outweigh the disadvantages. Engaging patients has been reported to promote their participation and sense of ownership of their care, which is essential in chronic disease management. Structured group diabetes education program can be effective in improving disease knowledge among adults with type 2 diabetes mellitus but individual one-on-one education session by healthcare workers should be considered an important factor in self-care programs. There is need to strengthening counselling, diabetes education, patient monitoring and follow up due to the poor control. Adherence to SMBG should be assessed at every hospital visit and the reasons for poor adherence should be sought. Furthermore, education should be spread across all the areas of self-care activities to achieve a good and optimal glycemetic control. Provision and availability of specialist in the PHC will help the patient and program yield a better outcome because it was observed that tertiary clinic participants consulted with specialist (registered dietician and certified educator) and their outcome was noticeable (ref). Providing unified diabetes self-care guidelines and policies for self-care activities programs of diabetes patient should be considered in SSA and Nigeria specifically. Since the peer support program is evidenced to be effective, hence, having an accredited training institution for the community and peer supporters can assist them have the required skills in supporting these patients. Lastly, further studies should be conducted on nurse led Clinic to evaluate the cost effectiveness.

4.2. Strength and Limitations

This is the first systemic review in SSA that discussed nurse led programs for self-care of T2DM. Only three publications from SSA were found on nurse led intervention programs for selfcare activities of T2DM, therefore more studies are needed. Additionally, some of the studies were not of a high quality based on the quality assessment criteria.

4.3. Conclusion

This project synthesized programs focusing on self-care for diabetic patients in SSA. It also proposed a protocol for a nurse-led clinic to empower newly diagnosed T2DM patients in FMC. The role of nurses in diabetes program are not well document in Nigeria and in Sub Sahara Africa. Nurses should undergo special training and take lead roles in diabetes self-care programs. Healthcare policy makers should provide unified, guidelines to promote and strengthening diabetes care in SSA.

APPENDIX 1: SEARCH STRATEGY USED FROM MEDLINE

1	diabetes mellitus, type 2/ or hyperglycemia/ or glucose intolerance/ or hypoglycemia/ or insulin coma/	196717
2	((("diabetes mellitus" adj3 onset) or (("diabetes mellitus" adj3 "type 2") or "type 2") or ("diabetes mellitus" adj3 "noninsulin dependent") or "non-insulin-dependent" or "noninsulin-dependent")).mp.	286099
3	(postprandial adj3 hyperglycemi*).mp.	1719
4	(glucose adj3 intoleran*).mp.	17642
5	((fasting adj3 hypoglycemi* or (postabsorptive adj3 hypoglycemi* or (postprandial adj3 hypoglycemi* or (reactive adj3 hypoglycemi*))).mp.	1313
6	((insulin adj3 coma) or (insulin adj3 shock)).mp.	1314
7	1 or 2 or 3 or 4 or 5 or 6	343200
8	"Africa South of the Sahara"/	12018
9	((sub-saharan adj Africa) or "Africa South of the Sahara").mp.	34449
10	exp Africa, Central/	16549
11	((Africa adj central) or Camero?n* or Yaounde or "central african republic" or "ubangi-shari" or Bangui or Chad or N'Djamena or Congo or Brazzaville or kinshasa or katanga or zaire or (Guinea adj Spanish) or (rio adj muni) or Malabo or Libreville or Gabon* or "Sao Tome and Principe").mp.	33563
12	exp Africa, Eastern/	68849
13	((Africa adj east*) or "british indian ocean territory" or Bujumbura or Burundi or Urundi or Djibouti or (french adj Somaliland) or Asmara or ERITREA or Ethiopia* or "Addis Ababa" or Kenya* or Nairobi or r*anda or SOMALIA or Mogadishu or "South Sudan" or Susan or Juba or Kharto? or Tanganyika or Tanzania or Zanzibar or Uganda or Kampala).mp.	90024
14	exp Africa, Southern/	69868
15	((africa adj southern) or Luanda or Angola or Bechuanaland or Botswana or Kalahari or Gaborone or Eswatini or Swaziland or Mbabane or Basutoland or Lesotho or Maseru or Lilongwe or Malawi or nyasaland republic of Malawi or (Maputo adj Mozambique) or (portuguese adj east adj Africa) or Windhoek or Namibia or (Southwest adj Africa) or Pretoria or Cape Town or Bloemfontein or (south adj Africa) or "union of south Africa" or Zimbabwe or (Rhodesia adj southern) or "RHODESIA NYASALAND" or Lusaka or (northern adj1 Rhodesia) or Zambi*).mp.	88426
16	exp Africa, Western/	69467
17	((Africa adj west*) or Benin or Dahomey or "Porto-Novo" or (burkina adj fas?o) or (upper adj volta) or "Caverde" or Praia or Abidjan or (cote adj d'ivoire) or "ivory coast" or Gambia or Banjul or Bathurst or Ghana or "gold coast" or Accra or Conakry or guinea or guinea-bissau or Monrovia or Liberia or Bamako or mali or Nouakchott or Mauritania or Niamey or niger or Abuja or Nigeria or Senegal or Dakar or Freetown or "sierraleone" or Lome or Togo*).mp.	263050
18	8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17	478373
19	7 and 18	2950

APPENDIX 2: INCLUSION AND EXCLUSION CRITERIA

Variables	Inclusion	Exclusion
Study Population	Type 2 diabetes	-Type 1 diabetes -Gestational diabetes
Area of interest	-Nurse led selfcare management programs -Diabetes self-management approaches by healthcare workers -Diabetes self-management policies and guidelines	Publications that discuss other areas other than type 2 diabetes and selfcare approaches /interventions /management
Content	-All countries in sub-Saharan Africa -Community settings, rural hospitals, urban and teaching hospitals.	Studies conducted outside Sub Saharan Africa
Study design	Qualitative and quantitative study studies of any design	
Language	English	Studies in other language

APPENDIX 3: QUALITY ASSESSMENT OF RANDOMIZED CONTROLLED TRIALS

Adapted from *Reeves BC, Deeks JJ, Higgins JP. 13 Including non-randomized studies. Cochrane Handb Syst Rev Interv. 2008;1:391.(Barnaby C Reeves)*

Author	Year	Response Rate	Sampling technique	sequence generation	allocation sequence concealment	blinding of participants and personal	incomplete outcome data	selective outcome reporting	other bias
Ernest Asante	2017 - 2018	-	Random sampling	+	+	+	+	+	+
Amendezo Etienne	2017	-	Random sampling	+/-	+/-	-	+	+	+/-
Natalie Leon	2013	-	Convenient sampling	+/-	+/-	+/-	+	+	+/-
Mash	2014	-	consecutive sampling	+	+	+/-	+	+	+/-
Muchiri	2015 and 2016	-	Convenient Sampling	+	+	+/-	+	+	+
Catherine	2018	-	consecutive sampling	+/-	-	-	+	+	+/-

(+): low risk of bias; (+/-): unclear risk of bias; (-): high risk of bias

APPENDIX 4: QUALITY ASSESSMENT OF INCLUDED CROSS-SECTIONAL STUDIES

Adapted from *National Heart and lung, a. B. I. Study Quality Assessment Tools*. Retrieved from <https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools>

#	Screening Questions
1	Did the study address a Clearly focused issue?
2	Did the authors use an appropriate method to answer their question?
3	Were the subjects recruited in an acceptable way?
4	Were the measures accurately measured to reduce bias?
5	Were the data collected in a way that addressed the research issue?
6	Did the study have enough participants to minimize the play of chance?
7	How are the results presented and what is the main result?
8	Was the data analysis sufficiently rigorous?
9	Is there a clear statement of findings?
10	Can the results be applied to the local population?
11	How valuable is the research?

Author	Year	Response Rate	Sampling technique	Screening questions												
				1	2	3	4	5	6	7	8	9	10	11		
Sanele Nkomani	2021	90.3%	Convinent Sampling	+	+	+	+	+	+	+	+	+	+	+	+	+
Kolawole	2009	-	Two stage and convinent sampling	+	+	+/-	+/-	+	-	+	+	+	+	+/-	+/-	+/-

(+): low risk of bias; (+/-): unclear risk of bias; (-): high risk of bias

APPENDIX 5: QUALITY ASSESSMENT OF PRE-POST, QUASI-EXPERIMENTAL STUDIES

Adapted from *National Heart and Lung, a. B. I. Study Quality Assessment Tools*. Retrieved from <https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools>

#	Screening Questions
1	Was the study question or objective clearly stated?
2	Were eligibility/selection criteria for the study population prespecified and clearly described?
3	Were the participants in the study representative of those who would be eligible for the test/service/intervention in the general or clinical population of interest?
4	Were all eligible participants that met the prespecified entry criteria enrolled?
5	Was the sample size sufficiently large to provide confidence in the findings?
6	Was the test/service/intervention clearly described and delivered consistently across the study population?
7	Were the outcome measures prespecified, clearly defined, valid, reliable, and assessed consistently across all study participants?
8	Were the people assessing the outcomes blinded to the participants' exposures/interventions?
9	Was the loss to follow-up after baseline 20% or less? Were those lost to follow-up accounted for in the analysis?
10	Did the statistical methods examine changes in outcome measures from before to after the intervention? Were statistical tests done that provided p values for the pre-to-post changes?
11	Were outcome measures of interest taken multiple times before the intervention and multiple times after the intervention (i.e., did they use an interrupted time-series design)?
12	If the intervention was conducted at a group level (e.g., a whole hospital, a community, etc.) did the statistical analysis take into account the use of individual-level data to determine effects at the group level?











Author	year	Response Rate	Sampling Technique	Screening questions											
				1	2	3	4	5	6	7	8	9	10	11	12
Bauman Linda	2014	-	convenient sampling	+	+	+/-	+/-	+	+	+	-	+/-	+	-	-
Assah	2009	-	consecutive sampling	+	-	+/-	+/-	+/-	+	+	-	-	+	-	-
Afemikhe and Chipps	2015	-	Quota sampling,	+	+	+	+	-	+	+	-	-	+	-	-
Muhoma	2020	+	convenient sampling	+	+	+	+	+	+	+	+	+	+	+	-
Pastakia	2015	-	consecutive sampling	+	+	+	+	+	+	+	+	+	+	+	-
Price	2011	-	consecutive sampling	+	+	+	+	+	+	+	+	+	+	+	-
Albertine	2013	-	consecutive sampling	+	+	+	+	+/-	+	+	+	-	+	+/-	-
Wambui	2015	-	consecutive sampling	+	+/-	+	+/-	+	+	+	+/-	-	-	+/-	-
Kengne	2009	-	Convenience Sampling	+	+	+	+	-	-	-	-	+	+	+	-
Rotheram-Borus	2012	-	Convenience Sampling	+	+	+	+	+/-	+/-	+/-	-	-	+	+	-

(+): low risk of bias; (+/-): unclear risk of bias; (-): high risk of bias+

APPENDIX 6: DIABETES SELF-MANAGEMENT GOALS

Diabetes is a very serious disease which may cause damage to the blood vessels and nerves leading to the brain, eyes, heart, kidneys, toes and feet.

You are the most important person in the management of your diabetes. We will guide you and offer support as you manage your diabetes. The following goals will help you gain and maintain diabetic control to reduce damage to your blood vessels and nerves.

Please choose goals you would like to work on to better manage your diabetes.		How confident are you that you can work on this goal? (1=not confident, 5=very confident)
	Goal 1: I will work hard to keep my HbA1c below 7.	1 2 3 4 5
	Goal 2: I will exercise (walk) 30 minutes _____ days per week. If I notice chest pain, shortness of breath, or chest tightness, I will seek medical attention.	1 2 3 4 5
	Goal 3: I will check my feet daily. If I notice a sore or irritation I will seek medical attention. I will visit the Podiatrist yearly, or as instructed.	1 2 3 4 5
	Goal 4: I will follow my diabetic and low fat diet to reduce my blood sugar and cholesterol.	1 2 3 4 5
	Goal 5: I will try to obtain my ideal body weight. I will lose _____ pounds by my next office visit.	1 2 3 4 5
	Goal 6: I will take a baby aspirin or enteric coated aspirin every day.	1 2 3 4 5
	Goal 7: I will stop smoking.	1 2 3 4 5
	Goal 8: I will have an eye exam every year or as indicated.	1 2 3 4 5
	Goal 9: I will check my blood sugar _____ times a day and will call if the results are consistently below _____ or above _____. (ADA recommendation is to maintain a blood sugar level between 80 and 130.)	1 2 3 4 5
	Goal 10:	1 2 3 4 5

	I will talk about how I feel about having diabetes to my family, friends, and/or chaplain. I will attend the Diabetes Support Group.	
--	--	--

Adapted from Research Institute of the Diabetes Academy Mergentheim
<https://eprovide.mapi-trust.org/instruments/diabetes-self-management-questionnaire>

APPENDIX 7

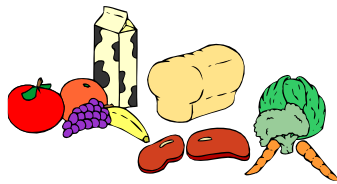
Name _____ Date ____/____/____

Diabetes Goal Agreement

To achieve good control of your diabetes it is important to have practical goals for yourself. Set one goal now and after you have achieved it, move on to another.



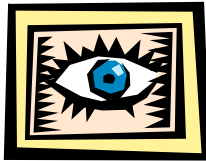
Exercise



Diet



Take Medications Properly



Eye Exam



Quit Smoking



Monitor Blood Sugar



Check Feet Daily



Dental Exam



Behavioral Health Exam

SELECTED GOAL: _____

ACTION PLAN: _____

BARRIERS & SOLUTIONS: _____

Adapted from Research Institute of the Diabetes Academy Mergertheim

<https://eprovide.mapi-trust.org/instruments/diabetes-self-management-questionnaire>

APPENDIX 8: DIABETES PROGRAM

		Date
<input type="checkbox"/> New diagnosis <input type="checkbox"/> Re-referral <input type="checkbox"/> Change of treatment		PHN
Name <small>(last) (first) (initial)</small>	<input type="checkbox"/> Male <input type="checkbox"/> Female <input type="checkbox"/> Pregnant	
Mailing Address <small>(postal code)</small>	Date of Birth <small>()</small> dd / mm / yy Age	
Telephone <small>(home) (work) (cell)</small>	Individual informed of referral <input type="checkbox"/> No <input type="checkbox"/> Yes	
Contact Person		Family Physician/NP
Referred by: <input type="checkbox"/> Family Physician/NP <input type="checkbox"/> Physician Specialist <input type="checkbox"/> Self <input type="checkbox"/> Other <small>(name) (title)</small>		
Type of diabetes (see back for diagnostic criteria) <input type="checkbox"/> Type 1 <input type="checkbox"/> Type 2 Symptoms of diabetes + casual plasma glucose (PG) value ≥ 11.1 mmol/L OR two fasting plasma glucose (FPG) ≥ 7.0 mmol/L OR PG 2hr sample of 75g OGTT ≥ 11.1 mmol/L OR A1C $\geq 6.5\%$ (type 2 only)*. *In the absence of unequivocal hyperglycemia with acute symptoms, a second test on a different day must be done for confirmation of diagnosis. <input type="checkbox"/> Prediabetes (see back for diagnostic criteria) <input type="checkbox"/> Other _____		Current Treatment <input checked="" type="checkbox"/> Nutritional management <input checked="" type="checkbox"/> Physical activity <input checked="" type="checkbox"/> Oral agent(s)/injectable (dosing/frequency) _____ _____ _____
Diagnostic Laboratory testing Fasting glucose _____ mmol/L Random glucose _____ mmol/L A1C _____ % Confirmatory test: (2 nd test on a different day) Fasting glucose _____ mmol/L Random glucose _____ mmol/L A1C _____ % Glucose tolerance test: _____ g Glucose 1 hour _____ mmol/L 2 hour _____ mmol/L	Recommended clinical tests/screening: (Indicate if completed) A1c <input type="checkbox"/> Yes <input type="checkbox"/> No Fasting lipid profile <input type="checkbox"/> Yes <input type="checkbox"/> No Creatinine <input type="checkbox"/> Yes <input type="checkbox"/> No Urine microalbumin (i.e. ACR) <input type="checkbox"/> Yes <input type="checkbox"/> No Retinopathy screen <input type="checkbox"/> Yes <input type="checkbox"/> No Resting ECG, if > 40 yrs of age or diabetes duration > 15 yrs <input type="checkbox"/> Yes <input type="checkbox"/> No TSH (Type 1 diabetes) <input type="checkbox"/> Yes <input type="checkbox"/> No ALT, CK (for statin therapy) <input type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Other Medications _____ _____ _____
Problems that may affect learning: <input type="checkbox"/> language barrier: primary language _____ <input type="checkbox"/> physically challenged <input type="checkbox"/> mentally challenged <input type="checkbox"/> literacy <input type="checkbox"/> unsuitable for group education - Reason: _____ <input type="checkbox"/> due to financial/social/emotional problems and/or attitude towards diabetes, this person would benefit from psychosocial counselling		
Date of diagnosis _____	Referral sent by: _____ <small>(print name) (signature)</small>	

Adapted from the Canadian Association Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada (2013):

Diagnosis of Diabetes

1. Symptoms of diabetes plus "casual" plasma glucose (PG) value ≥ 11.1 mmol/L. Casual is defined as any time of the day without regard to time since last meal. The classic symptoms of diabetes include fatigue, polyuria, polydipsia, and unexplained weight loss.
OR
2. A fasting plasma glucose (FPG) ≥ 7.0 mmol/L. Fasting is defined as no calorie intake for at least 8 hours.
OR
3. The PG value in the 2-hour sample of the 75g OGTT is ≥ 11.1 mmol/L.
OR
4. A1C $\geq 6.5\%$.

Confirmatory Test

In the absence of unequivocal hyperglycemia with acute symptoms, values above these criteria must be confirmed by a second test on a different day.

Glucose levels for diagnosis

Category	A1C	FPG mmol/L	PG 1 hr after 75g glucose load mmol/L	PG 2 hr after 75 g glucose load, mmol/L
Prediabetes	6.0 - 6.4%	6.1-6.9 (IFG)	N/A	7.8-11.0 (IGT)
Diabetes Mellitus (DM)	$\geq 6.5\%$ (type 2)	≥ 7	N/A	≥ 11.1
Gestational Diabetes (GDM)*		≥ 5.3	≥ 10.6	≥ 9.0

*Screen at 24 to 28 weeks gestation with a 50g oral glucose challenge (earlier in high risk patients).

• If ≥ 11.1 mmol/L, GDM is present and the 75g OGTT is unnecessary.

• If 7.8-11.0 mmol/L, a 75g OGTT is recommended. If one of the following values is met or exceeded (with a 75g OGTT), GDM is present.

- FPG ≥ 5.3
- 1 hr PG ≥ 10.6
- 2 hr PG ≥ 9.0

Targets for Good Diabetes Control

Glycated Hemoglobin (HbA1c): Measure every 3 to 6 months, preferably every 3 months if not at target. Target for most patients: $\leq 7.0\%$
Alternate target (consider for patients in whom it can be achieved safely) $\leq 6.5\%$

Glycemic targets should be individualized based on age, duration of diabetes, risk of hypoglycemia, life expectancy and history of cardiovascular disease.

Blood glucose: Optimal glucose control in adults and children over age 12

- Fasting or AC 4-7mmol/L
- 1 or 2 hour PC 5-10 mmol/L (5-8 mmol/L for optimal control)

Lipids: Measure fasting at diagnosis and repeat every 1 to 3 years as clinically indicated

Primary target LDL-C ≤ 2.0 mmol/L

ECG at baseline and every 2 years in patients:

- Age > 40 years • Duration of diabetes >15 years and age > 30 years. • End organ damage • Cardiac risk factors

Blood pressure: Measure at diagnosis and every 3 to 4 months thereafter unless otherwise indicated

- BP in people with DM <130/80

Screening for Diabetic Nephropathy using a random urine albumin to creatinine ratio

- Type 1 diabetes - annually after puberty in those with diabetes of ≥ 5 years' duration
- Type 2 diabetes - at diagnosis and then annually
- Serum creatinine levels (should be measured) and a GFR annually in those patients with diabetes without albuminuria and at least every 6 months in those with albuminuria

Annual foot examination for all people with diabetes, starting at puberty. Those at higher risk for foot problems (previous ulceration, neuropathy, structural deformity, peripheral vascular disease and/or microvascular complications) may require more frequent foot examinations.

- Type 1 diabetes - annually after 5 years duration of Type 1 in post-pubertal individuals
- Type 2 diabetes - annually

Retinal Eye examination

- Type 1 diabetes - annually 5 years after the onset of diabetes in individuals ≥ 15 years of age
- Type 2 diabetes - at diagnosis and then every 1 to 2 years

Adapted from the Canadian Association Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada (2013)

APPENDIX 9: DIABETES SELF-CARE MANAGAMENTS QUESTIONNAIRE

The following statements describe self-care activities related to your diabetes. Thinking about your self-care over the last 8 weeks, please specify the extent to which each statement applies to you. Note: If you monitor your glucose using continuous interstitial glucose monitoring (CGM), please refer to this where ‘blood sugar checking’ is requested.	Applies to me very much	Applies to me to a considerable degree	Applies to me to some degree	Does not apply to me
1. I check my blood sugar levels with care and attention. Blood sugar measurement is not required as a part of my treatment.				
2. The food I choose to eat makes it easy to achieve optimal blood sugar levels.				
3. I keep all doctors’ appointments recommended for my diabetes treatment.				
4. I take my diabetes medication (e. g. insulin, tablets) as prescribed. Diabetes medication/insulin is not required as a part of my treatment.				
5. Occasionally I eat lots of sweets or other foods rich in carbohydrates.				
6. I record my blood sugar levels regularly (or analyse the value chart with my blood glucose meter). Blood sugar measurement is not required as a part of my treatment.				
7. I tend to avoid diabetes-related doctors’ appointments.				
8. I do regular physical activity to achieve optimal blood sugar levels.				
9. I strictly follow the dietary recommendations given by my doctor or diabetes specialist.				
10. I do not check my blood sugar levels frequently enough as would be required for achieving good blood glucose control. Blood sugar measurement is not required as a part of my treatment.				
11. I avoid physical activity, although it would improve my diabetes.				
12. I tend to forget to take or skip my diabetes medication (e. g. insulin, tablets). Diabetes medication/insulin is not required as a part of my treatment.				
13. Sometimes I have real ‘food binges’ (not triggered by hypoglycaemia).				
14. Regarding my diabetes care, I should see my medical practitioner(s) more often.				
15. I tend to skip planned physical activity.				
16. My diabetes self-care is poor.				

<https://eprovide.mapi-trust.org/instruments/diabetes-self-management-questionnaire>

APPENDIX 10: DIABETES MANAGEMENT CHECKLIST

The following is a summary of the guidelines that can help you manage your diabetes for a lifetime of good health.

1. Plan what you eat and follow a balanced meal plan. See your dietitian **at least once a year.**
2. Exercise at least five times a week for 30 minutes each session. Talk to your doctor before starting any exercise program. Tell your doctor what kind of exercise you want to do so adjustments can be made to your medicine schedule or meal plan, if necessary.

Follow your medicine schedule as prescribed by your doctor.

3. Know what medicines (brand and generic names) you are taking and how they work. Always keep a list of your medicines with you.
4. Test your blood glucose regularly, as recommended by your health care provider. Test your blood glucose more often when you're sick.
5. Try to continuously keep your blood glucose level at the recommended range. If your blood glucose is less than 70 mg/dl and you have more than one unexplained low blood glucose reaction a week, call your doctor/nurse. If your blood glucose is greater than 160 mg/dl for more than a week or if you have two consecutive readings greater than 300 mg/dl, call your doctor.
6. Contact your doctor when your blood glucose is over 300 mg/dl.
7. Record your blood glucose and urine ketone test results in a record keeping log. Bring your logbook with you to all your doctor's visits.

8. Keep your scheduled appointments with your health care providers. See your doctor at least every three to four months for regular check-ups if you are treated with insulin. See your doctor every four to six months if you are treated with other diabetes medicines or if you are managing diabetes with diet and exercise alone. More frequent visits might be necessary if your blood glucose is not controlled or if complications of diabetes are progressing. Make sure your health care provider checks your blood pressure and weight and examines your feet and insulin injection sites.
9. Have a glycosylated hemoglobin test (HbA1c) at least two times a year or more frequently as recommended by your doctor.
10. Have an eye exam (including a retinopathy screening test) and urinalysis test once a year, or as recommended by your doctor. (Your doctor might request that you have these tests more frequently.)
11. Have your cholesterol and triglyceride levels checked (lipid profile test) once a year.
12. Have a dental exam every six months.
13. If you have any signs of infection, call your doctor or health care provider.
14. Practice good foot and skin care.
15. DO NOT SMOKE.
16. Try to manage stress as best as you can. You might think about attending a stress management workshop to help you learn better coping methods.
17. Discuss your travel plans with your doctor. Make sure to bring enough medicine and supplies with you on your trip. Keep medicines, syringes, and blood glucose

testing supplies in your carry-on bag. Do not check these supplies in case your luggage is lost.

18. Continue learning about your diabetes to maintain and improve your health.

Attend a diabetes class, support group or schedule visits with your diabetes nurse educator at least once a year.

APPENDIX 11: PATIENT SELFCARE ACTIVITIES EDUCATION CONTENT

Adapted from the Canadian Association Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada (2013):

Group Education

What is diabetes

A condition in which the body does not properly utilize the glucose from the food we eat.

Sources of glucose are food with high content of carbohydrate and sugars such as bread, potatoes, rice, cakes and fast foods.

Deficiency of insulin from the pancreas or inability of the insulin to reach the body cells leads to excessive glucose in the body system and the body becomes weak.

What is type 2 diabetes

Type 2 diabetes is a disease in which your pancreas does not produce enough insulin, or your body does not properly use the insulin it makes. As a result, glucose (sugar) builds up in your blood instead of being used for energy. Body needs insulin to use the glucose.

Signs and symptoms of type 2 diabetes

Increased thirst, frequent urination, increased hunger, unintended weight loss, fatigue, blurred vision Slow-healing sores, frequent infections, numbness or tingling in the hands or feet.

Complications of type 2 diabetes

High blood glucose levels can cause complications such as blindness, heart disease, kidney problems, nerve damage and erectile dysfunction.

Complications can be delayed through good diabetes care and management like

Eating healthy meals and snacks

- Enjoying regular physical activity
- Monitoring your blood glucose using a home blood glucose meter *
- maintaining healthy body weight
- Taking diabetes medications prescribed by your doctor
- Managing stress effectively

c. Diet

Healthy diet (fruits and vegetables, meat and other proteins, and low-fat milk)of handy portion three times daily.

Limit the intake sugar, sweets and food high in fat.

Eat more high-fiber foods such as whole grain breads and cereals, lentils, dried beans and peas, brown rice, vegetables and fruits

d. Medication adherence

Adherence to prescribed drugs is a component of selfcare activities for diabetes. It is important to adhere strictly to prescribed medications to ensure optimal glycemic control and to prevent diabetes related complications. Take the prescribe medication at the right time and make sure to take the right dosage. Do not stop the medication without consent of health care provider. Talk to our nurse or doctor if you have any complaints or reactions to the drugs. Check your blood glucose when taking the drugs and eat the right diet to complement effect of the medication.

e. Physical exercise

Incorporate physical exercise slowly and gradually into your daily routine,

Stay active throughout the week and walk instead of taking a taxi

Exercise at least 30 mins per day.

f. Self-monitoring of blood glucose

- This will provide you with information on the effect of diet, physical exercise and medication on your blood glucose
- A blood glucose machine, glucose strip, sharp box and record book are needed for this
- Frequency of blood sugar monitor depend on the severity of the condition ,nut with minimum of once per day at alternate times.
- It is important to document the value for healthcare tam to monitor your progress and make adjustment to your treatment when necessary.

g. Steps for Blood Glucose Monitoring

- Wash hands in warm water and dry well. No need to use alcohol. Alternate sites (areas other than your hands) should not be used until at least 2 hours after eating.
- Place blood test strip in blood glucose machine.
- Load lancet device with lancet. Massage your finger base to tip. Hold lancet device to either side of the fingertip. Press button to stick finger. Hold hand below your heart and wait 5-10 seconds. Working from the base of the finger,

gently squeeze to obtain a drop of blood. Gently touch and hold the blood drop to the strip while the strip draws the blood into the strip.

- Wait while the machine determines blood glucose result.
- Remove the lancet and dispose it off in sharp container
- Dispose the test strip.

g. Alcohol and diabetes

- Generally, there is no need to avoid alcohol because you have diabetes. You should avoid drinking alcohol if you are;
- pregnant or trying to get pregnant, breastfeeding, have a personal or family history of drinking problems, planning to drive or engage in other activities that require attention or skill are taking certain medications.
- Alcohol should be limited to 2 standard drinks/ day or less than 10 drinks/ week for women and less than 3 standard drinks/ day or less than 15 drinks/ week for men.
- Diabetes patient taking excessive alcohol can be at risk of affect judgement, empty calories that might lead to weight gain, increase blood pressure and triglycerides, damage to liver and nerves including brain and sexual organs, inflammation of the pancreas, dehydration , worsen eye disease
- Heavy alcohol drinkers (more than 3 drinks daily) are strongly advised to reduce the amount of alcohol they drink. Heavy alcohol use can make blood glucose control more difficult and increases other health risks.
- People with diabetes should discuss alcohol use with their diabetes healthcare team

g. Diabetes and smoking

- Smoking is one of the causes of diabetes, it makes it difficult for people with diabetes to control their sugar level and developing complications(heart and kidney disease, retinopathy and peripheral neuropathy).
- It is strongly advised that you quit smoking. If you need help, we will link you up with a support group.

h. Low blood sugar

Low blood sugar (hypoglycemia) is defined as a blood sugar level below 70 milligrams per deciliter (mg/dL), or 3.9 millimoles per liter (mmol/L).

Common causes of diabetic hypoglycemia include:

- Taking too much insulin or diabetes medication
- Not eating enough
- Postponing or skipping a meal or snack
- Increasing exercise or physical activity without eating more or adjusting your medications
- Drinking alcohol

a. Signs and symptoms of diabetic hypoglycemia include:

Shakiness, Dizziness, Sweating, Hunger, Fast heartbeat, Inability to concentrate, Confusion, Irritability or moodiness, Anxiety or nervousness, Headache

If it occurs at midnight, signs and symptoms maybe

Damp sheets or nightclothes due to perspiration, nightmares, tiredness, irritability or confusion upon waking

b. Treatment of low blood sugar

Pay attention to the early warning signs of hypoglycemia and treat low blood sugar promptly. You can raise your blood sugar quickly by eating or drinking a simple sugar source, such as glucose tablets or fruit juice. Tell family and friends what symptoms to look for and what to do if you're not able to treat the condition yourself.

c. Prevention of hypoglycemia

- Monitor your blood sugar. Careful monitoring is the only way to make sure that your blood sugar level remains within your target range.
- Don't skip or delay meals or snacks.
- Measure medication carefully and take it on time. Take your medication as recommended
- Adjust your medication or eat additional snacks if you increase your physical activity.
- Eat a meal or snack with alcohol if you choose to drink.
- Record your low glucose reactions. This can help you and your health care team identify patterns contributing to hypoglycemia and find ways to prevent them.
- Carry some form of diabetes identification so that in an emergency others will know that you have diabetes.

h. High blood sugar

High blood glucose, or hyperglycemia, occurs when the amount of glucose in your blood has increased above the normal range

High blood glucose may occur when you:

- Due sickness or infection
- eat too much.
- do not exercise enough.
- do not take enough medication or insulin.

Signs and Symptoms of high blood sugar

- weakness or fatigued
- Feeling hungry.
- extremely thirsty.
- frequently urinating.
- Blurred vision

Treatment of high blood Sugar

Check your blood glucose level if you experience any signs of high blood sugar. If sugar level is above 11.0 mmol/L, follow the treatment recommendations provided by the diabetes health care team. If the high blood glucose is persisted, you may need to adjust your meal plan, physical activity, and/or medication.

Prevention

- Follow your diabetes meal plan and be consistent about the timing of meal and snacks

- Monitor your blood sugar according to the treatment plan. Careful monitoring is the only way to make sure that your blood sugar level remains within your target range. Note when your glucose readings are above or below your goal range.
- Take your medication as prescribed by your doctor.
- Adjust your medication if you change your physical activity. The adjustment depends on the blood sugar test results and on the type and length of the activity.

Footcare

Too much glucose in the blood can damage the nerves and blood vessels in the feet.

This can result in a loss of sensation manifesting as not feeling a foot injury such as a blister or a cut. If unnoticed or untreated, a sore can quickly become infected and potentially lead to serious complications.

Common foot problems

- Some common foot problems that can lead to pain or infections include:
- Corns and calluses – a thick layer of skin.
- Blisters – areas of the skin that are raised and filled with fluid.
- Ingrown toenails – edges of the toenails grow into your skin.
- Bunions – a bump at the outside edge of your big toe.
- Plantar warts – small, flesh-colored growths on the bottom of your feet.
- Hammertoe – toes that curl under your feet.
- Dry and cracked skin – rough, scaly, and flaking skin.
- Athlete’s foot – a fungus that causes itching, burning, redness and cracking of your skin.

- Fungal function – toenails appear yellow, green, brown, or black and are thick and hard to cut.

Care of the foot

- Take care of your diabetes and keep your blood glucose levels within the normal range.
- Check your feet daily for cuts, cracks, ingrown toenails, blisters, etc.
- Wash your feet daily and dry them carefully, especially between the toes.
- Keep your skin soft and smooth by applying cream or lotion to your heels and soles daily, but not between the toes.
- When needed, trim your toenails straight across, but not too short.
- Change your socks daily and wear good supportive shoes.
- Elevate your feet when you are sitting.
- Wiggle your toes and move your ankles up and down for a few minutes.
- Exercise regularly.
- See a foot care specialist if you need advice or treatment, including orthotics.
- What are some things I shouldn't do when caring for my feet?
- Visit a podiatrist yearly for foot screening

Keeping good care of your feet is important, some things you should not do

include:

- Don't wear tight shoes, socks, knee-highs; or high heels, pointed-toe shoes or sandals.
- Don't put hot water bottles or heating pads on your feet.
- Don't walk barefoot inside or outside.

- Don't sit or cross your legs for long periods of time.
- Don't use over-the-counter medications to treat corns and warts.
- Don't wear over-the-counter insoles as they can cause blisters.
- Don't have pedicures by non-health care professionals.
- Don't smoke.

I. Dental(oral) care

Dental health is important, especially if you have diabetes. Poorly managed blood glucose (sugar) levels can lead to severe toothaches or other dental problems.

Signs of dental problems with diabetes

Tooth decay (cavities), early gum disease (gingivitis) and advanced gum disease (periodontitis)

Preventing dental problems with diabetes

- brush your teeth at least twice a day (morning and night)
- use a soft toothbrush and tooth paste with fluoride
- rinse your toothbrush after each brushing and store upright (with bristles at the top) to help keep bacteria from going on your toothbrush
- Get a new toothbrush at least every three months
- floss your teeth at least once a day to remove plaque;
- schedule regular dental appointments twice a year to have your teeth cleaned.
- make sure your dentist knows you have diabetes.
- look for early signs of gum disease (redness, swelling, dry mouth, loose teeth or mouth pain)
- keep false teeth clean.
- don't smoke (talk to your nurse practitioner about ways to quit smoking).

Diabetes and Eye

Diabetes increases the risk of developing eye problem. Signs of eye problems with diabetes include difficulty reading, blurring or double vision, pressure or pain in your

eyes, blind spots, dark spots. flashing lights, rings around lights. floaters or cobwebs in field of vision.

Eye problems associated with diabetes are.

- Cataract: The lens of the eye becomes cloudy.
- Glaucoma: The pressure inside the eye rises and damages the optic nerve.
- Retinopathy: The blood vessels in the back of the eye become weak and bleed, causing damage to the retina. The retina is the coating inside the back of your eye that reacts so you can see.

To avoid eye problems associated with diabetes, you should:

- manage your diabetes
- monitor your blood glucose levels
- keep your blood pressure and cholesterol under control
- quit smoking; and
- see an eye care professional every 1-2 years for a complete eye exam (be sure to let them know you have diabetes).

C. Mobile application and social media platform

- Patients that attended the group education session will be guided on how to install the diabetes blood glucose tracker on their android phone and how to use it.
- The mobile app tracks blood glucose ,weight, blood pressure and A1C.It assist in keeping values of blood sugar reading in one place therefore making it easy to track.

- The application gives weekly, monthly and three months average statistics of inputted blood glucose value
- It gives reminder and notifications of selfcare activities at specified time on daily basis
- Blood glucose unit is in both mg/dl and mmol/dl
- It gives daily tips on how to improve selfcare activities(diet, medication, foot care etc.)
- All the patients will be added to the diabetes clinic page on Facebook and WhatsApp group to keep them updated and to motivate them. Tip on diabetes selfcare activities will be shared on the group,
- After the group education, patient will have consultation with the endocrinologist with the laboratory investigation results. The endocrinologist will make inference based on the laboratory report and values and then prescribe medications.
- After the consultation with the consultant, each patient will be given an appointment date for individual consultation with the diabetes nurses. Each patient will have at least one visit to the clinic on monthly basis for checkups and follow-up care
- They will also be given pamphlets and hand flyers on selfcare activities to serve as a guide and reference

APPENDIX 12: PRISMA CHECKLIST

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	
	10b	List and define all other variables for which data were sought (e.g. participant and intervention	

		characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	
Study characteristics	17	Cite each included study and present its characteristics.	
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	

Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	
	23b	Discuss any limitations of the evidence included in the review.	
	23c	Discuss any limitations of the review processes used.	
	23d	Discuss implications of the results for practice, policy, and future research.	
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	
Competing interests	26	Declare any competing interests of review authors.	
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting

systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71
For more information, visit: <http://www.prisma-statement.org/>

APPENDIX 13: EVALUATION AND INDICATOR

	Objectives	Activities	Process Indicator	Data collection method	Impact indicator	Data collection method
1	<ul style="list-style-type: none"> • The nurses will effectively plan, manage and coordinate diabetes program in the clinic in collaboration with other healthcare professionals starting January 2022 • To improve the knowledge of nurses on selfcare management of type 2 diabetes patient within the first two 	<ul style="list-style-type: none"> • Workshop and training for registered nurses on DSME 	<ul style="list-style-type: none"> • Workshop organized for nurses in the clinic 	<ul style="list-style-type: none"> • A 2-day workshop will be held 	<ul style="list-style-type: none"> • 90% of the nurses will attend the workshop. • 90% of the registered nurses effectively planned, managed and coordinated the diabetes program in the clinic • 80% of those that attend will demonstrate increased knowledge in DSME 	<ul style="list-style-type: none"> • Observation

	weeks of the training					
2	<ul style="list-style-type: none"> To improve patient knowledge and participation in selfcare activities within 6months of intervention 	<ul style="list-style-type: none"> Initial group education session on diabetes and selfcare activities lasting 30-40mins Individualized education session to identify patient challenges ,set goals and have goal agreement 	<ul style="list-style-type: none"> Group education and individual education session 	<ul style="list-style-type: none"> Group education session on first visit and subsequently alternating between individual and group education session 	<ul style="list-style-type: none"> 90% of patient will have improved knowledge in selfcare activities 90% of the patient will attend group and individualized education session 90% of the patient will participate actively in their self-care activities 	<ul style="list-style-type: none"> Questionnaire, Oral interview , medical record database

		lasting 30-40mins				
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3	<ul style="list-style-type: none"> To improve patient glycemic control within 3 months of intervention 	<ul style="list-style-type: none"> Teach and demonstrate how to self-monitor blood glucose using a glucometer and glucose strip. Teach patient how to record daily blood glucose value in a logbook Introduce patient to Mobile app (diabetes diary -blood glucose tracker)to keep track of their blood glucose, weight, blood pressure and A1C Follow-up patient through mobile phone call ,sending text messages and reminders 	<ul style="list-style-type: none"> Demonstrate to patient how to use glucometer, strip and lancets Teach patient when how to record daily blood glucose value using logbook and mobile app Call patient once in a week and send text message 	<ul style="list-style-type: none"> Teach of SMBG on first visit and any other time that is necessary Give patient logbook Show patient how to use Mobile app on first visit and any other time that is necessary Mobile phone call once a week 	<ul style="list-style-type: none"> 80% of the patient will perform self-glucose monitoring at home 80% of patient will have a logbook and document their blood glucose value daily 70% will report utilizing the mobile app tracker daily 90% of the patient will adhere to prescribed medication ,diet and physical exercise 90% of the patient will be followed up via mobile phone call (once a week) and text messages(twice a week) 	<ul style="list-style-type: none"> Oral interview , Medical record database
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		on selfcare activities.				
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4	<ul style="list-style-type: none"> To prevent diabetes related complications at 6months, 1year and throughout the program 	<ul style="list-style-type: none"> Ensure patient maintain a normal range of HBA1C, blood glucose level and blood pressure (investigations at 1st visit, at 3 and 6 months and at 18months) Initial and yearly screening for retinopathy, neuropathy and foot examination. 	<ul style="list-style-type: none"> Assess laboratory investigation at baseline and at 6 and 18 months Initial and yearly screening for retinopathy, neuropathy and foot examination at 12month 	<ul style="list-style-type: none"> laboratory investigations Screening for complications 	<ul style="list-style-type: none"> 70% Patient will maintain a normal range of HBA1C(less than or equal 7%), FBS(70–130 mg/dl (3.9–7.2 mmol/l), blood pressure(130/80mmhg) 80% of the patient will undergo screening for retinopathy, neuropathy and foot examination at 6month and subsequently yearly. 	<ul style="list-style-type: none"> Medical record database
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APPENDIX 14: PROGRAM TIME ESTIMATION

	Task	Personel Responsible	Resources Needed	Estimated Time	Due Date	Time Accomplished
	A 2 day workshop for the registered nurses on DSME	Advance Public Health Nurse	Program goal and objectives Training manual on DSME	2 days	Jan-21	
	Patient assessment and Patient group education, SMBG, Mobil app usage	RN 1	Sphygmomanometer, weighing scale. Posters, leaflets, audiovisual aids, glucometer, strips, lancets	6 months	Jun-21	
	Individual education session for patients	RN 2	DSME documents (patient questionnaire, checklist, goal setting and goal agreement)	6 months	Jun-21	
	Mobile phone call follow-up, text messages and appointment reminder	RN 2	Mobile phone ,patient directory	6 months	Jun-21	
	Social media Platform (Facebook and WhatsApp group)	RN 1	Mobile phone ,patient directory and/ computer	6 months	Jun-21	
	Laboratory Investigation evaluation	RN 1	Patient file	6 months	Jun-21	
	Referrals for screening for complication	RN 2	Patient file or record	12 months	Dec-21	

	Program monitoring and evaluation	Advance Public Health Nurse	Patient record and Medical record database	6 months	Jun-21	
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APPENDIX 15: BUDGET

Items	Quantity	Cost
Sphygmomanometer	3	30,000
Weighing scale	2	21,000
Glucometer	3	35,000
Glucometer Strip	5000	30,000
Lancets	5000	15,000
Stethoscopes	3	15,000
Urinalysis equipment's	2	25,000
DSME documents	5000 copies	10,000
Mobile Phones	2	60,000
Mobile Monthly Subscriptions and call card	6	70,000
Educational Materials	6000 copies	20,000
Sharp box	20	10,000
Hand sanitizers, detergents, hand wash	30	35,000
Miscellaneous		25,000
Total		#386,000

APPENDIX 16

Home Blood Glucose (Sugar) Results

Name:					Phone:			
Medications:						Recommended Blood Glucose goals: Before meals: 4 – 7 mmol/L 1.5 – 2 hrs after meals: 5 – 10 mmol/L		
Date	Before Breakfast	2hrs after Breakfast	Before lunch	2 hrs after lunch	Before Supper	2hrs after Supper	Before bed Snack	Notes:

Adapted from the Canadian Association Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada (2013)

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