Original Article

Adapting a Diabetes Self-Management Program for Primary Healthcare in Ethiopia: An Implementation Science Study Using the IM-ADAPT Framework

Yimer Seid Yimer[1*], Ahmed Ali Ahmed[1], Adamu Addissie[1], Ahmed Reja[2]

Abstract

Background: Diabetes self-management interventions are highly context- specific, and implementing them without appropriate adaptation may reduce their effectiveness. Achieving an optimal fit within a local healthcare context requires a systematic adaptation process.

Objective: To adapt the Self-Management Resource Center's Diabetes Self-Management Program (SMRC-DSMP) for implementation in primary healthcare (PHC) facilities in Ethiopia.

Methods: The SMRC-DSMP was adapted for adults (≥18 years) with type 2 diabetes using an implementation science adaptation study guided by the Intervention Mapping (IM-ADAPT) framework. The adaptation process comprised four phases: (1) needs and capacity assessment, (2) identification of evidence-based interventions, (3) adaptation planning, and (4) implementation of adaptations. Stakeholders reviewed the original program and contributed to the adaptation process by identifying context-specific modifications. A draft program was subsequently developed, refined through a verification workshop, and finalized as the Ethiopian Diabetes Self-Management Program (E-DSMP). Adaptations were documented using the FRAME framework for Reporting Adaptations and Modifications-Expanded (FRAME).

Results: Core behavior change strategies: including action planning, goal setting, problem solving, social support, and role modeling were retained. Key program components such as educational workshops, ongoing support, feedback, and educational materials were largely considered suitable for the Ethiopian context. Group-based, face-to-face delivery and session duration were maintained. However, community-based implementation was deemed t infeasible due to limited infrastructure and social networks. Healthcare professionals, supported by trained peers, were incorporated as facilitators, reflecting strong patients' high level of trust in healthcare providers. The adapted program retained core content areas, including healthy eating, physical activity, action planning using implementation intentions (if-then plans), identification of barriers and brainstorming of solutions, peer-led group sessions for sharing experiences.

Conclusions: The adapted diabetes self-management program has the potential to benefit adults with newly diagnosed or poorly controlled type 2 diabetes and supports its implementation within primary healthcare settings in Ethiopia. This study also demonstrates a systematic approach to adapting evidence-based interventions for new contexts, highlighting the value of stakeholder engagement throughout the adaptation process. Further research is needed to evaluate the program's feasibility, acceptability, and effectiveness under real-world implementation conditions. [*Ethiop. J. Health Dev.* 2026; 40(2)]

Keywords: Adaptation; diabetes self-management program ; type 2 diabetes; Primary Healthcare ; Ethiopia; IM-ADAPT; FRAME framework.

Introduction

The advancement of diabetes and its sequelae can be stopped or delayed through strict glycemic control [1]. To reach or keep up the target of glycemic control, diabetes requires a broad management plan, where patients are advised and supported to make informed decisions about healthy eating, being active, monitoring, taking medication, problem solving, healthy coping, and reducing risks [1].

According to the Ethiopian National treatment guideline on major NCDs, glycaemic targets with optimal management for non-pregnant adults with diabetes need to be a capillary fasting plasma glucose (FPG) of 80-130 mg/dl, or Postprandial (2 hours after the beginning of a meal) plasma glucose < 180 mg/dl, or glycosylated hemoglobin (HgA1c) < 7% [2]. However, a Meta-analysis of 16 studies in Ethiopia showed that only 34.4% of diabetes patients achieved good glycemic control based on FBG measurements (FPG level of≤130 mg/dl) and 33.2%, based on HgA1c level of ≤7% [3]. The percentage of diabetic patients with poor glycaemic control ranged from 48.7% to 82% in other studies conducted in public hospitals of Ethiopia [4-12].

To enhance the availability and reach of appropriate services for individuals with NCDs in primary care settings, Ethiopia adopted the WHO-PEN disease management protocols [13] and developed national NCD management protocols in 2021 [2], which recommend diabetes education and self-management as the cornerstone of diabetes management. Despite such recommendations, there is a scarcity of locally appropriate and effective diabetes self-management programs (DSMP) in order to reach those recommendations. To reach the National NCDs management recommendations, appropriate self-management practice is critical for patients with diabetes to reach the chosen treatment goals and for the prevention of complications.

[1] Department of Epidemiology and Biostatistics, School of Public Health, Addis Ababa University, Addis Ababa, Ethiopia.

[2] Department of Internal Medicine, School of Medicine, Addis Ababa University, Addis Ababa, Ethiopia.

***Corresponding Author E-mail: yimer.seid@aau.edu.et**

Orcid: https://orcid.org/0000-0001-7824-4361

Several evidence- based DSMPs [14-23], including the Self-Management Resource Center's Diabetes Self-Management Program (SMRC-DSMP) in the US [24], have shown that DSMPs improve self-management practice and glycemic control in T2D patients. Although DSMPs have shown efficacy and effectiveness in developed countries, it is not known whether these interventions are also effective in Ethiopia. Moreover, locally appropriate implementation strategies and related barriers and facilitators are not known. Application of existing EBIs in new contexts may be more efficient than developing new ones, as they have already demonstrated effectiveness, reduce the risk of failure, save time and resources, and can be implemented more quickly[25]. However, ensuring that an intervention aligns well with its context requires deliberate and systematic adaptation. Because many population health issues and interventions are strongly influenced by context, applying an intervention in a new setting without adjustment may reduce the likelihood of achieving positive outcomes.

Therefore, a systematic approach to adapting DSMP and formulating effective implementation strategies is a necessary step for sustainable use of self-management programs over the long term in primary healthcare contexts in Ethiopia. This study is therefore aimed at adapting SMRC-DSMP to the Ethiopian primary healthcare context.

Methods

Setting and Context of Practice

The SMRC-DSMP was adapted for implementation in primary healthcare facilities (health centers) in Addis Ababa, Ethiopia. In Ethiopia, health centers represent the first level of the healthcare system providing curative services. Diabetes care at the primary healthcare level is delivered through chronic disease outpatient clinics by general practitioners, nurses, and/or public health officers. During the study period, no structured diabetes self-management program was available in these settings. Diabetes education was provided only occasionally and on an individualized basis, typically during routine monthly follow-up visits and medication refills appointments, rather than through a structured self-management program.

Target Population

The intervention targeted adults aged 18 years and older with type 2 diabetes, excluding pregnant women. The target population included both individuals who were newly diagnosed and those already receiving treatment for type-2 diabetes.

Adaptation process

The adaptation was conducted using an implementation science approach guided by the Intervention Mapping for Adaptation of EBIs (IM-ADAPT) framework [26] and the Framework for Reporting Adaptations and Modifications-Expanded (FRAME) [27]. We completed the first four steps of the IM-ADAPT framework to identify an evidence-based intervention (EBI), determine what and how to adapt, and implement the adaptations while preserving the intervention's core components.: These steps included: 1) assessing needs and organizational capacity, (2) identifying appropriate EBIs, (3) planning adaptations based on fit `assessments, and (4) Implementing the adaptations.

The IM-ADAPT framework was selected because it provides detailed, practical guidance for each stage of the adaptation process and has been widely applied in the development and adaptation of health promotion interventions. The resulting modifications and adaptations were systematically categorized and reported using the FRAME framework. [27].

A multidisciplinary research team comprising public health experts, behavioral specialists, diabetologists, and bioethicists coordinated the adaptation process. Across different stages of the IM-Adapt framework, diabetes experts, non-communicable disease (NCD) program leaders, health facility managers, healthcare providers, and people living with T2D contributed to identifying and refining context-specific adaptations. Final decisions regarding modifications to the intervention were made by the research team after considering stakeholder input.

Step 1: Assess needs, challenges and organizational capacity

We conducted in-depth interviews with 22 people living with type 2 diabetes (PLWT2D) and key informant interviews (KIIs) with 25 healthcare professionals (HCPs) and health system managers to explore the needs, challenges, and existing support for diabetes self-management within Ethiopia's primary healthcare setting.

In addition, we conducted facility assessment to understand the availability of resources and diabetes services that influence diabetes self-management practices. We also discussed these findings with health center managers, and reviewed diabetes care processes across 26 health centers using the WHO Service Availability and Readiness Assessment checklist for NCD services [30]. Detailed methods and findings related to the assessment of needs, challenges, and organizational capacity have been reported elsewhere[28].

Step 2: Find evidence-based interventions (EBIs).

A comprehensive electronic literature search was conducted to retrieve available diabetes-specific self-management programs from PubMed, Google Scholar, and communityguide.org. We also searched registries of systematic reviews from the Cochrane Database of Systematic Reviews to retrieve additional interventions. The search was conducted with search terms: ((“Diabet* mellitus” OR “diabet*” OR “noninsulin” OR “hyperglycemia” OR “type 2*” OR “T2DM” OR “T2D” OR “type 2 diabet*” OR “type II diabet*” OR “non-insulin dependent diabet*” OR “NIDD”) AND (“Diabet* self-management education” OR “diabet* self-management educational program” OR “diabet* self-care education” OR “nurse-led diabet* self-management education” OR “diabet* self-management intervention” OR “diabet* self-

management intervention program" OR "diabet* self-care intervention" OR "nurse-led diabet* self-management intervention" OR "lifestyle behavior change intervention" OR "lifestyle behavior change intervention" OR "structured lifestyle diabet* education program" OR "self-management education" OR "self-support education" OR "self-care education")). Following the IM-Adapt framework, the adaptation team comprising public health experts, behavioral specialists, diabetologists, and bioethicists selected the candidate EBI based on availability and ease of use of materials, use of behavior change theories and techniques/mechanisms, evidence of effectiveness, and how best it fits with the national NCD management protocols [2] and WHO-PEN [13] lifestyle modification and self-management recommendations.

Step 3: Assess fit and plan adaptations

Using the SMRC-DSMP leader manual [24], we conducted a systematic assessment of the candidate evidence-based intervention (EBI). Specifically, we (3A) assessed the alignment of the intervention with the targeted behavioral and environmental outcomes; (3B) evaluated the suitability of the behavioral and environmental determinants, as well as the methods used to influence them, within the new context; (3C) examined the compatibility of the original delivery methods, design features, and cultural components with the target setting and population; (3D) assessed the fit of the implementation strategies for the new context; and (3E) identified the intervention's core components and determined how they could be preserved throughout the adaptation process.

Step 4: Make adaptations (modify materials and activities).

The fourth step involved the following tasks: (4A) preparing design documents and adaptation drafts, (4B) conducting a validation workshop to review the adapted materials, and (4C) producing the final adaptations. Accordingly, a format for collecting stakeholder opinions and feedback (**Supplementary file 1 in page 15**) was presented to different stakeholders, and adaptation ideas and opinions were collected from experts and different stakeholders. Data were collected from eight health care professionals (HCPs) at eight health centers; six people living with T2D patients, six non communicable diseases (NCDs) program managers (3 from Sub City Health Office, one from regional health bureau, one from partner non-governmental organizations (NGOs) supporting diabetes program and one from Ministry of Health-Ethiopia (MoH-E); two diabetes experts (diabetologists); and one nutritionist. Participants were contacted by email, telephone, and/or face-to-face, and we collected their opinions on how and what to adapt. Then we prepared a to-do list of what to adapt based on the [27, 29] adaptation category. Using the to-do list, the adaptation team then: (4A) prepared a draft Ethiopian diabetes self-management program (E-DSMP); (4B) conducted a verification workshop to review the adapted materials, during which we used a virtual Delphi meeting with selected stakeholders who had contributed adaptation ideas during the initial round to gather their final input and build consensus on the adapted DSMP. When we faced competing ideas, we followed the consensus decision-making process to determine the best and most mutually acceptable choice by considering the generally accepted opinion within the participants or among the members of the adaptation team, and (4C) we consolidated the mutually agreed-upon ideas and finalized the adapted materials, resulting in the Ethiopian Diabetes Self-Management Program (E-DSMP).

Ethical consideration

Ethical clearance was obtained from the Institutional Review Board (IRB) of the College of Health Sciences, Addis Ababa University (Protocol number: 104/22/SPH). Before participation, the purpose of the study was clarified to the study participants, and participation in the study was completely voluntary. Informed verbal consent was obtained from each study participant prior to data collection. Participants were informed of the potential benefits of the study and that participation posed no more than minimal risk. . Confidentiality was maintained throughout the study, and anonymous participant identification codes were used during data collection and analysis. Participants were informed of their right to decline participation or refuse to answer any question without any consequences. Upon request, appropriate diabetes-related health information was provided to participants.

Results

Step 1: Needs Assessment, Organizational Capacity, and Logic Models

The needs assessment showed that inadequate diabetes self-management is a key contributor to poor blood glucose control among patients with T2D. Patients faced several challenges, including misconceptions, limited health literacy, dietary habits, lack of glucometers, financial difficulties, age-related barriers, and comorbid conditions. Health system-related barriers included a shortage of trained staff, lack of health insurance coverage, insufficient diabetes education, limited educational resources, and poor access to affordable diagnostic services. At the community level, barriers included weak social support, self-stigma, religious fasting practices, and limited availability of diverse food options. Patients preferred easily accessible educational tools such as pamphlets, mobile messages, and locally produced television programs. Healthcare providers highlighted the need for culturally relevant guidelines adapted to the local context, with a focus on improving patient understanding and delivering individualized care. We used the needs and organizational assessments to create a logic model of the problem (poor diabetes self-management) shown in **Figure 1** using the socio-ecological model [30]. Such a logic model describes the behavior of risk (poor diabetes self-management practice) of patients with T2D, as well as personal and environmental determinants of the behavior of risk. The findings from this assessment of needs, challenges, and assets are reported elsewhere [28].

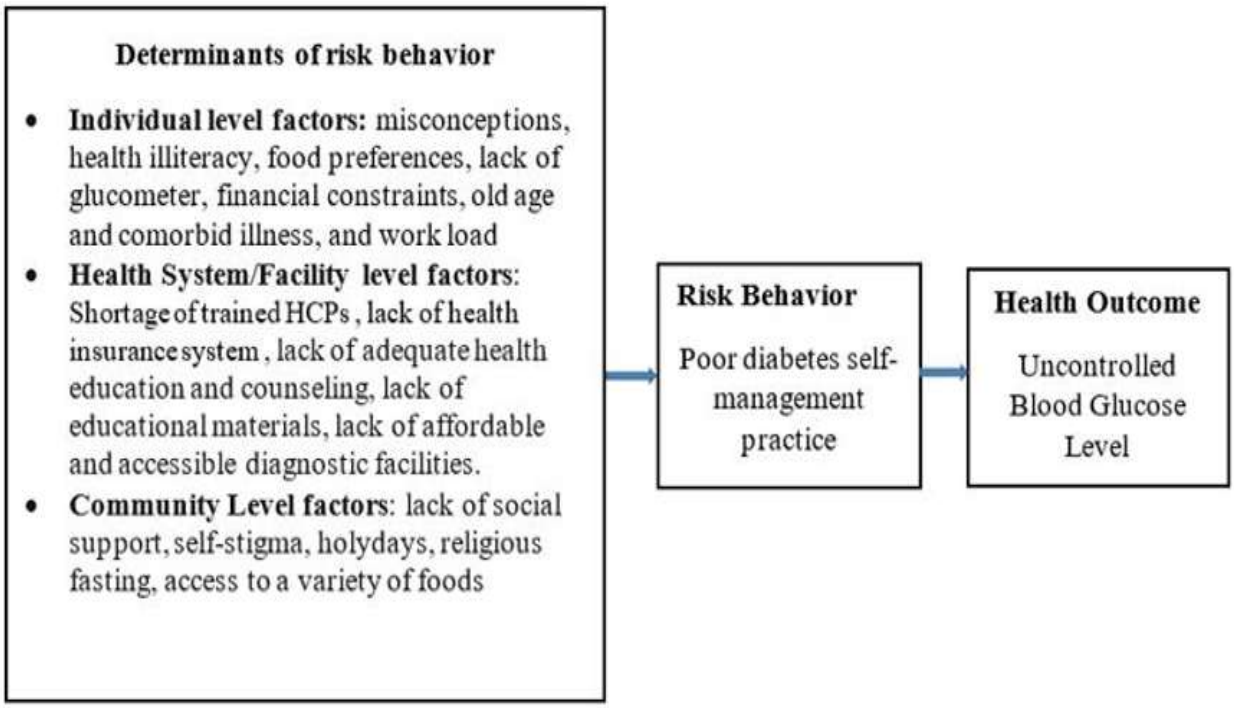

Figure 1: Logic model of the problem in diabetes self-management among type 2 diabetes patients in Ethiopia.

Step 2: Searching, selecting, and assessing the basic fit of evidence-based interventions (EBIs)

A thorough electronic literature search was carried out to identify existing diabetes-specific self-management programs. Accordingly, we found nineteen diabetes self-management education and support interventions or programs, majority of them based in the United State and Europe. Those interventions included: SMRC-DSMP [31], Healthy Changes for Living with Diabetes [32], the Community Diabetes Education (CoDE) program [18], the Diabetes Education and Empowerment Program (DEEP) [33], The "Wisdom, Power, Control" Program [19], Picture Good Health [34], the Lifestyle Improvement through Food and Exercise (LIFE) intervention [14], and Diabetes One Day (D1D) Program [35] in the US; Diabetes Education and Self-Management for Ongoing and Newly Diagnosed (DESMOND) [16], the Diabetes X-PERT Programme [15], and the Diabetes Manual 1:1 structured education [17] in the UK; Beyond Good Intentions [36] in the Netherlands; Self-Management Promotion Educational Program [37] in Iran; the Structured Intensive Diabetes Education Programme (SIDEP) in South Korea [20]; the Rethink Organization to iMprove Education and Outcomes (ROMEO) intervention in Italy [21]; the Comprehensive Lifestyle Modification Program (CLMP) in South Korea [22]; the Structured Individual-based Lifestyle Education (SILE) program in Japan [23]; the Lifestyle Over and Above Drugs in Diabetes (LOADD) [38] in New Zealand, and Effects of the First Line Diabetes Care (FiLDCare) self-management education and support program in Philippines [39]. Basic characteristics of identified diabetes self-management education and support interventions or programs were presented in **Supplementary file 2 (page 19).** Then, we selected the SMRC-DSMP as a candidate EBI to be adapted to the Ethiopian context.

Description of the EBI of interest

The SMRC-DSMP is an evidence- based program (EBP) that has been rigorously tested in controlled settings, proven effective, and translated into practical models [31]. The Program is designed to help adults who have T2D control their HbA1C's and reduce the complications associated with diabetes. The SMRC-DSMP is a 6-week program offered for 2.5 hours weekly by two trained peer leaders. Topics covered in the DSMP include an overview of self-management and diabetes, healthy eating, physical activity, monitoring blood glucose, preventing complications, and working with a health care team. The program is highly interactive, with an emphasis on action planning and problem solving. It uses skill- building, goal-setting, role modeling, and reinforcement with the goal of enhancing participants' self-efficacy. Program content included all areas of the American Association of Diabetes Care and Education Specialists (AADCES) standards [1], with two exceptions. The actual process of glucose monitoring is not included, although monitoring is discussed. Although there is a general discussion of medications, there is no discussion of specific medications, nor is insulin injection covered. The SMRC-DSMP was originally tested and is being implemented in community settings such as churches and senior centers (elderly care homes). SMRC's diabetes self-management workshop overview is shown in **Supplementary file 3 (page 22)**. Detailed descriptive information about the content and processes of the SMRC-DSMP can be found in [24].

Step 3: Assess fit and plan adaptations

To assess fit and plan adaptation, first, we requested and obtained a formal research license (License ID: 79802) from the self-management resource center (SMRC) and were able to access program materials. We also bought a copy of the book "Living a healthy life with chronic conditions, 5th edition," which is part of the program from Bull Publishing Company (License Code: C5-PDF-Z538BDHJ746). Second, a logic model of change was created to illustrate how theory-based methods and strategies were expected to first affect behavioral determinants and subsequently address the identified behavioral problems, or intervention targets, in order to achieve the desired health outcomes. The characteristics of the candidate EBI were found to be compatible with the logic model of change **(Figure 2)**.

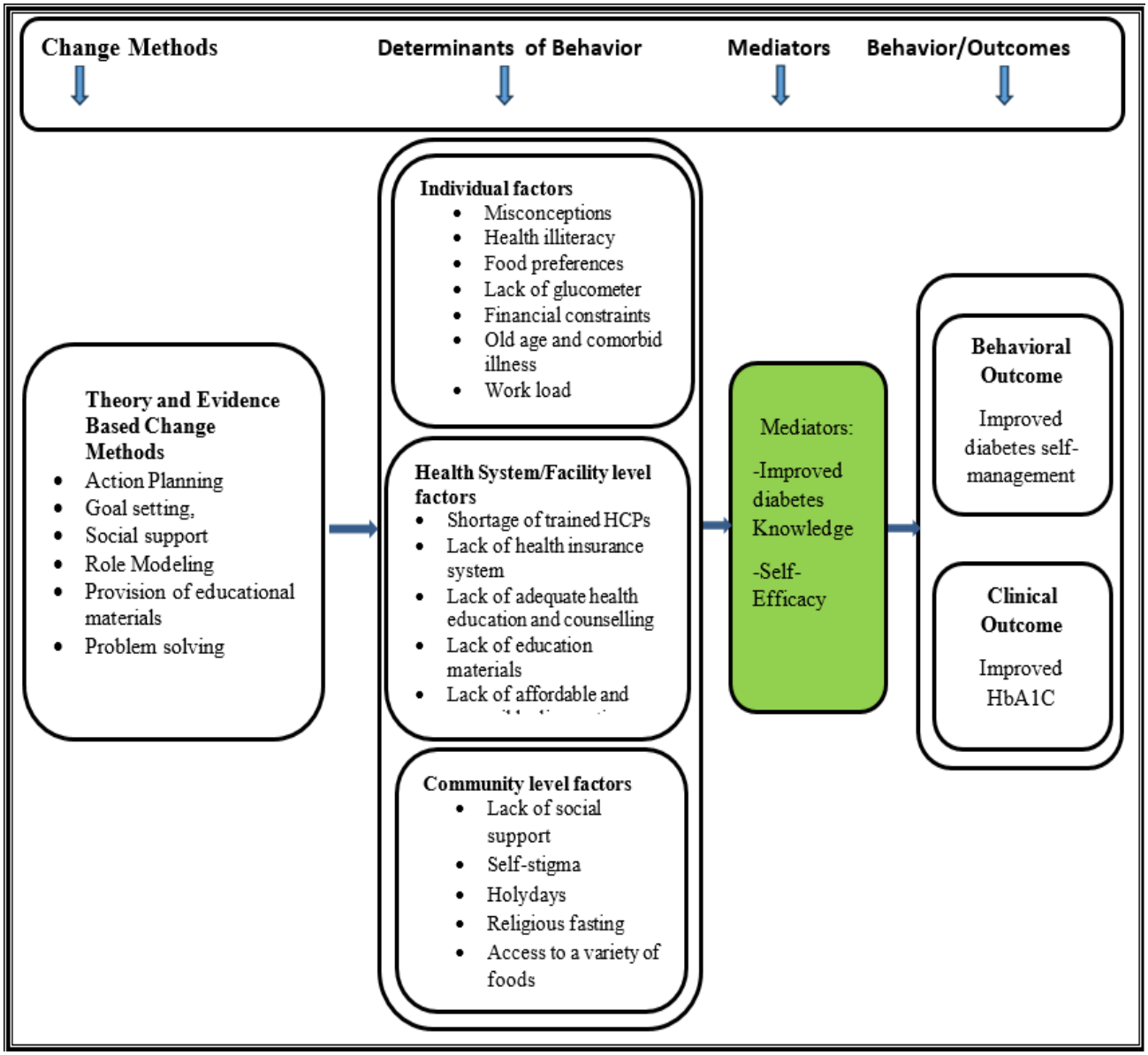

Figure 2: Logic model of change in diabetes self-management

Third, we summarized and noted proposed adaptation ideas from stakeholders on an adaptation "to-do list" **(Table 1)** in six categories, including Content, Service setting, target audience, mode of delivery/format, cultural adaptations, and core components. Fourth, with the SMRC-DSMP leader manual, the logic model of change, and the to-do list, we reviewed how well the candidate EBI fits in the new setting.

Table 1: Adaptation to-do list to adapt SMRC-DSMP to the primary healthcare context in Ethiopia

Adaptation category [27, 29]	Sample adaptation ideas (Quotations) taken from stakeholders' opinion
Content	• For participants who cannot read, homework assignments could be provided as audio recordings that they can listen to at their convenience (HCP). • Most people cook food at home. We could ask patients about the type of oil or butter they used and estimate the amount of fat they used. Food labels are not applicable in our setup. Therefore, we can discuss with the patient the amount and type of fat used (Dietitian). • Portion size or serving size may not be applicable for our patients. Local meals don't have a standard serving size. Instead, we may use the plate methods instead (Diabetologist). • Using plates, cups, and common household items to show portion sizes can assist in understanding appropriate portions (Diabetologist) • The body scan relaxation exercise may not be acceptable because some community members associate it with inappropriate spiritual practices. (NCD program manager) • Medication adherence and medication misconceptions related topics should be added in session six. Many are afraid of the injections and are terrified of them being lifelong (HCP). • Incorporating examples of healthy snacks during the break as a refreshment makes the workshop entertaining and successful (HCP). • For participants without home glucose monitoring devices, blood glucose testing could be conducted at the health facility, with reserved testing supplies for workshop participants. (NCD program manager) • Monthly follow-up calls and/or meetings after the workshop, lasting up to 6 months, could help ensure long-term sustainability (NCD program manager).
Service setting adaptation	
Setting	• Facility level implementation is more feasible. However, arranging an independent center may be a better option, as it would allow for more effective promotion, advertising, and the ability to attract participants (NCD program manager) • The workshop setting should be arranged at a walking distance around participant's residence. The primary health care setting is also applicable since it was structured by locality. For large organizations Banks, Ethio-Telecom, Ethiopian airlines etc, we may arrange the workshop at their premises –They have too many workers living with diabetes ((Diabetologist). • Recruiting participants from the Ethiopian Diabetes Association and using the association's infrastructure could be feasible and applicable instead of health facilities or other community resources (NCD program manager).
Workshop leader/Intervention providers	• It's better to consider health professionals as intervention providers instead of peer leaders. If possible, a psychiatrist should be involved (HCP). • Two trained leaders, one of whom should be a health professional, and the second one a non-health professional with diabetes (HCP) • It is better to always have one health professional and one non-HCP since many of our patients have strong beliefs about HCPs (Diabetologist). • In sessions related to healthy eating plans and menu planning, inviting a dietitian or nutritionist will be more effective (HCP).
Fit with other interventions	• The current national NCD treatment protocol recommends a three-month period for lifestyle intervention, making this timeframe suitable for integrating the proposed program (NCD program manager). • Through the outreach family health service and health extension workers, we can promote the program in the community (NCD program manager). • Program coordination could be aligned with the outpatient department service for NCDs (NCD program manager).
Resource (Budget, Space, Equipment, Supplies)	• There should be a reserved place for the workshop where it will always be non-occupied (HCP). • To increase reach, the health center conference hall could be used on Saturday morning for conducting the workshops (NCD program manager). • The program should be provided free of charge to patients. By highlighting the benefits of this setup, you can consider selling this project to NGOs (HCP). • At PHC setups, the meeting hall could be a comfortable place for training (HCP).

	• Reconsider the frequency and timing of blood sugar measurements to accommodate the limitations and challenges our participants face in accessing diagnostic tests (HCP). • With a small budget, the program could be started as a pilot in a few health facilities (NCD program manager). • Space may not be a problem, as it may be done at the patients' waiting area during late working hours (NCD program manager). • Workshop overview, homework handout, and the book need to be translated into the local language, simplified, and focused on diabetes self-management. Considering a booklet instead of a book may be appropriate (NCD program manager). • Planning per diem for facilitators or intervention providers is crucial for the effectiveness of the program (NCD program manager). • Materials from the Ethiopian Diabetes Association and the Ministry of Health could be adapted and used instead of the book (diabetologist).
Target Audience Adaptations	
Participants	• We should focus on type 2 diabetes only. Minimize the number of participants to 8–10 so that each patient is engaged and able to participate effectively (Diabetologist). • For individuals who are unable to read or write, we can involve family members or caregivers in the workshops to help with reading or explaining the educational materials. Alternatively, audiovisual resources can be considered as a viable option (HCP). • Considering that newly diagnosed people living with T2D may result in better adherence to the program (HCP). • Newly diagnosed people living with T2D with uncontrolled blood glucose may be more interested in this program since they don't want to start medication immediately after diagnosis (NCD program manager)
Mode of delivery/format Adaptations	
Number of sessions	• A one-hour session per month for six months instead of a 2:30 session per week for six weeks could be effective (NCD program manager)
Technological format	• Since most of the participants are elderly and illiterate, try to make all communications in person (HCP).
Session length	• The duration of workshops should not exceed 1 hour (HCP). • I believe that our community members may need more in-depth guidance and clarification on certain subjects. So, extend the 2:30-hour session length to 3:00 (HCP).
Cultural Adaptations	
Cultural sensitivity	• Sometimes participants object to relaxation, body scans (meditation) techniques for religious reasons. Instead of that, consider some religious practices, like praying (NCD program manager). • The menu planning and food guide should take into account the economic and dietary culture in the Ethiopian context (HCP). • Consider the local language (Amharic) as a medium of instruction (NCD program manager).
Consistency with belief system	• Considering fasting seasons and balancing DSMP with religious requirements like "tsom, selot, and subae" in Amharic, is needed. We have a religious society (HCP).
Core Intervention Components Preserved	
core behavior change methods	• To ensure the program's effectiveness, we need to maintain certain mechanisms of action, such as action planning, goal setting, problem solving, social support, and role modeling (HCP)

Judging determinants and change methods fit in the new setting.

We examined that the SMRC-DSMP aligns well with the targeted behavioral and environmental determinants of diabetes self-management in the new context. The proposed EBI effectively addressed all identified contributors to suboptimal diabetes self-management across multiple levels, including individual, health system/facility, community, and environmental factors.

Similarly, as shown in the logic model of change (Figure 2), five core behavior change methods were identified as contributing to the effectiveness of the original DSMP. . Those change methods may have contributed to positive diabetes self-management behavior by improving behavior mediators, specifically self-efficacy, knowledge, and skills. The change methods included action planning, goal setting, problem solving, social support, and role modeling. All of those change methods could be applied to the new setting. The Social Cognitive Theory (SCT)[40] was retained as the primary behavior change theory underpinning the adapted DSMP. Key SCT constructs, including goal setting, outcome expectations, knowledge and behavioral skills, problem-solving, role modeling, experience sharing, self-efficacy, and social support, were integrated into the adapted program.

Judging Delivery fit, Design Features, and Cultural Elements

Most components of the original SMRC-DSMP, including educational workshops, ongoing support for diabetes self-management behaviors, behavioral feedback, and the provision of educational materials, were considered appropriate for the Ethiopian primary healthcare setting. However, the dietary guidance, including healthy eating plans and menu development based on the original program's food guide and dietary framework, was not suitable for the local context and was therefore adapted to reflect locally available foods and dietary practices.. Similarly, carbohydrate counting and food label reading were not applicable because locally prepared foods are not standardized with respect to packaging, nutritional labeling or serving sizes. In addition, the body scan relaxation exercise, which was included as a stress management technique in the original program, was removed because it was considered culturally and personally unacceptable to some participants for religious or other personal reasons.. The original SMRC-DSMP uses the book "Living a Healthy Life with Chronic Conditions, 5th Edition" as the main reference material. This resource was not considered feasible for use in the Ethiopian context; therefore, it was replaced by appropriate educational materials, such as booklets and handouts. The original program also recommends self-monitoring of blood glucose on two selected days (one workday and one non-workday), including measurements before breakfast, two hours after a meal, and after exercise. This recommendation was not feasible in the new setting because of limited availability of blood glucose monitoring equipment and testing supplies.

Judging implementation strategies fit to the new setting

The original's program face-to-face, group-based delivery format and session duration were considered appropriate for the new setting, as they are consistent with the national NCD management protocol and PEN NCD lifestyle management guidelines.

However, implementation in community settings was not considered feasible because the local context lacks the social support networks and infrastructure necessary to support community-based program delivery. Consequently, the adapted program was designed for implementation within primary healthcare facilities.

In addition, healthcare professionals (HCPs), supported by trained peer facilitators, were selected to deliver the workshops because participants expressed a high level of trust and confidence in healthcare providers. This adaptation was intended to enhance the credibility, acceptability, and feasibility of the program within the Ethiopian primary healthcare context..

Deciding Core Intervention Components

Healthy eating, physical activity, action planning, problem solving, and social support were identified as the core intervention components to be retained in the adapted program.

Step 4: Make Adaptations

Supplementary file 4 in page 23 summarizes the adaptations made to the original DSMP and describes the key features of the adapted Ethiopian Diabetes Self-Management program (E-DSMP). Stakeholders provided valuable input on both the content and process of adaptation, as summarized in the adaptation to-do-list (Table 1). The major adaptations are described below:

Targeted Participants

To align with the National NCD Management Protocol and enhance program acceptability, the adapted DSMP was initially designed to target adults who were newly diagnosed with type 2 diabetes, had uncontrolled T2D, and/or supported by a family member involved in diabetes care. Subject to resource availability, the program could be expanded to include all adults living with diabetes. .

Program Format

To optimize resource utilization, the minimum workshop group size was increased to 12 participants, and the average workshop duration to 2 hours and 15 minutes.

Workshop Facilitators

The adapted DSMP was designed to be delivered by one trained healthcare professional (HCP) and one trained peer facilitator selected from among people living with diabetes who had received appropriate training. This adaptation reflected participants' strong trust in healthcare professionals while preserving the value of peer support.

Venue and Delivery Setting Due to a lack of appropriate space and infrastructure for community setup in the new setting, we brought the workshop venue to primary health care clinics (health centers), which again could improve convenience for HCPs and facilitate integration with existing National NCD Management protocols.

Workshop Sessions

Several modifications were made to the workshop sessions to improve their relevance and acceptability within the Ethiopian context while preserving the core components of the original program.

In Session 1 (Activity 3), information addressing common misconceptions about diabetes was added because these misconceptions were identified as an important determinant of diabetes self-management in the local context.

In Session 2, the menu planning component was removed and incorporated into Session 4 to improve the sequencing of dietary education.

In Session 3, the session on dietary fat was replaced with a broader focus on food choices, as excessive fat consumption is less common in the study setting and estimating dietary fat intake was not considered applicable. This modification provided participants with more practical guidance on making healthier food choices using locally available foods.

In Session 4, carbohydrate counting and food label reading were removed from the menu planning component because packaged foods with standardized nutrition labels and serving sizes are not widely available in the local context. Healthy eating guidance was adapted in accordance with the Ethiopian Food-Based Dietary Guidelines [41], and the plate method, and menu examples were revised to reflect commonly consumed local foods.

In Session 5, the body scan relaxation exercise was removed because it was considered culturally and religiously sensitive, and some participants might associate it with religious practices that differ from their own.

To promote the maintenance of self-management behaviors beyond the six-week workshop, monthly follow-up telephone calls were added for three months after completion of the program. These follow-up contacts were intended to reinforce participants' action plans, provide ongoing support, and encourage sustained behavior change.

Homework assignments and materials

We opted for locally suitable home-based reading materials, such as booklets or leaflets, as the book “Living a Healthy Life with Chronic Conditions” was neither affordable nor practical in the Ethiopian context.

In addition, because of the limited availability and high cost of blood glucose monitoring equipment and testing supplies, the original self-monitoring schedule was modified to include a single blood glucose measurement during Weeks 1 and 5 of the program.

A summary of the adaptations made to the SMRC-DSMP for the Ethiopian context is presented in Figure 3 using the Framework for Reporting Adaptations and Modifications–Expanded (FRAME)

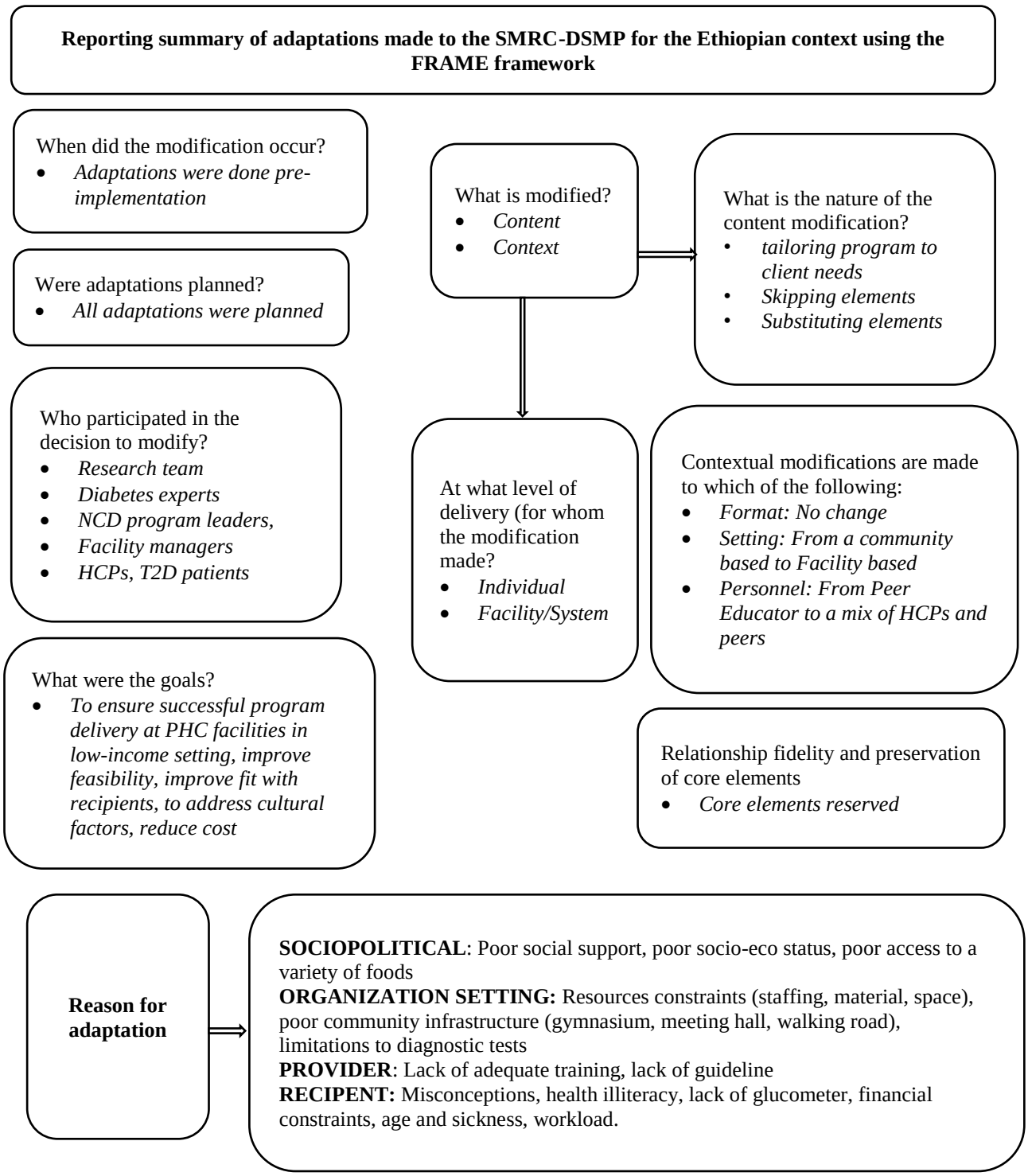

Figure 3: Reporting summary of adaptations made to the SMRC-DSMP for the Ethiopian context using the FRAME

Discussion

Our study shows the adaptation of an evidence-based diabetes self-management program (DSMP), originally developed at Stanford University, for a primary healthcare setting in Addis Ababa, Ethiopia. The adaptation was guided by the Intervention Mapping Framework (IM-ADAPT) [26], which provides a systematic, stepwise approach to identifying evidence-based interventions (EBIs), assessing their suitability for a new population and setting, and determining which components should be adapted while preserving their core elements [42]. The resulting modifications were subsequently categorized and reported using the Framework for Reporting Adaptations and Modifications–Expanded (FRAME) [27]. Using FRAME strengthens methodological rigor by documenting not only the adaptations themselves but also their timing, context, rationale, and implementation process, thereby facilitating implementation, scale-up, dissemination, and sustainability [27]. This approach is particularly valuable because developing new interventions from the ground up is often impractical when effective EBIs already exist or when resources such as time and funding are limited.

Our comprehensive electronic literature search revealed a number of diabetes-specific self-management interventions, of which the SMRC-DSMP[31] was judged to be most appropriate for the Ethiopian context. The SMRC-DSMP is a well-established evidence-based intervention that has been rigorously evaluated in controlled settings, demonstrated effectiveness, and been translated into practical models[31]. Although the program has shown efficacy and effectiveness in high-income settings, its effectiveness in low-resource contexts such as Ethiopia remains uncertain. Adapting interventions with an established evidence base is generally more efficient than developing new interventions; however, maximizing their effectiveness in a new setting requires careful and systematic contextual adaptation..

The rationale for this study was based on the recognition that population health challenges and intervention effectiveness are strongly influenced by context. Implementing an intervention without appropriate adaptation may reduce its effectiveness and limit its ability to achieve the intended outcomes [25]. The needs assessment, reported elsewhere [28], informed the development of a logic model of the problem, which identified poor diabetes self-management behaviors among people with type 2 diabetes and the associated individual and environmental determinants. A corresponding logic model of change was then developed to illustrate how theory-informed methods and practical strategies were expected to influence these determinants and, ultimately, improve diabetes self-management behaviors. A similar adaptation approach has been reported in a study conducted in South Africa [43]. The adapted program retained the original behavior change methods, including action planning, goal setting, problem solving, social support, and role modeling. These methods are expected to improve diabetes self-management by enhancing self-efficacy, knowledge, and behavioral skills. All behavior change methods were grounded in Social Cognitive Theory (SCT), which was retained as the primary theoretical framework underpinning the adapted DSMP. The importance of behavior change theories in promoting effective diabetes self-management interventions has been consistently demonstrated in the literature [44].

Most of the original SMRC-DSMP components, including educational workshops, ongoing support for self-management behaviors, behavioral feedback, and provision of educational materials, were considered appropriate for the Ethiopian context. Similarly, the face-to-face, group-based delivery format and session duration were retained because they align with Ethiopia's National Noncommunicable disease (NCD) Management Protocol and the World Health Organization (WHO) Package of Essential Noncommunicable Disease Interventions (PEN) lifestyle management guidelines. However, community-based implementation was not considered feasible because of limited social support networks and infrastructure within the study setting [45, 46]. Consequently, the adapted program was designed for delivery within primary healthcare facilities. In addition, healthcare professionals, supported by trained peer facilitators, were selected to deliver the workshops because previous findings indicated that participants had a high level of trust in healthcare providers [28].

Healthy eating, physical activity, action planning, problem solving, and social support remain core intervention components of the adopted program. These elements are identified as core intervention elements in the SMRC Implementation and Fidelity Manual 2022 [24] and have demonstrated effectiveness in several other studies[14, 16-23, 32, 34-39]. Core intervention components are the essential elements responsible for producing the intervention's primary effects and should therefore be preserved during adaptation and implementation to maintain fidelity and maximize the likelihood of achieving outcomes comparable to those observed in the original intervention. [47].

Limitation of the study

Although this study employed a systematic approach to adapting an evidence-based intervention (EBI), incorporating a structured adaptation framework, multiple data sources, and extensive stakeholder engagement, several limitations should be acknowledged. First, the adaptation was informed primarily by formative research, expert judgment, and stakeholder perspectives rather than evidence generated through actual implementation. Consequently, some adaptations may not fully reflect implementation challenges encountered in routine practice. Second, adaptations undertaken before implementation may not capture all context-specific issues, as additional modifications often emerge during real-world implementation. Nevertheless, pre-implementation adaptation is generally considered a proactive approach, whereas modifications introduced during implementation are reactive. Proactive adaptation may also be more resource-efficient by identifying and addressing potential barriers before implementation begins.

Conclusion

This study describes the systematic adaptation of an evidence-based diabetes self-management program (DSMP), originally developed at Stanford University, for implementation within primary healthcare settings in Ethiopia. The adapted program has the potential to benefit adults with newly diagnosed or poorly controlled type-2 diabetes. Given the limited availability of structured, contextually appropriate diabetes self-management programs in Ethiopia, the adapted Ethiopian Diabetes Self-Management Program (E-DSMP) represents a promising intervention for integration into primary healthcare services.

This study also demonstrates how researchers and practitioners can apply a structured implementation science approach to adapt evidence-based interventions for new settings while preserving their core components. The findings further underscore the importance of engaging stakeholders throughout the adaptation process to enhance the acceptability,

feasibility, implementation, and long-term sustainability of adapted interventions. Future research should evaluate the feasibility, acceptability, implementation outcomes, and effectiveness of the E-DSMP under real-world conditions.

Acknowledgements
The authors sincerely thank the data collectors, stakeholders, people living with type 2 diabetes, healthcare professionals, and health system managers who generously contributed their time and expertise to this study.

Data Availability
All data generated or analyzed during this study are included in this published article and its supplementary information files.

Conflicts of interests
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Funding Statement
The data collection for this study was supported by the Research and Technology Transfer Office of Addis Ababa University (Grant No. NA). The funding bodies had no role in the design of the study, collection, analysis, interpretation of data, or preparation of the manuscript.

Authors' Contributions
Conceptualization: YSY
Data curation: YSY, AAA, AA, AR
Formal analysis: YSY, AAA, AA, AR
Funding acquisition: YSY, AA
Investigation: YSY, AAA, AA, AR
Methodology: YSY, AAA, AA, AR
Project administration: YSY; AAA, AA; AR
Resources: YSY, AA
Supervision: YSY, AAA, AA, AR
Validation: YSY, AAA, AA, AR
Visualization: YSY; AAA, AA, AR
Writing – original draft: YSY; AAA, AA, AR
Writing – review & editing: AAA; AA, AR

Abbreviations
AADCES: American Association of Diabetes Care and Education Specialists
cRCT: clustered randomized controlled trial
DSMP: Diabetes Self-Management Programs
E-DSMP: Ethiopian-Diabetes Self-Management Program
EBIs: Evidence- Based Interventions
FBS: Fasting Blood Sugar
FRAME: Framework for Reporting Adaptations and Modifications-Enhanced
HbA1C: Glycated Hemoglobin.
HCP: Health Care Professionals
IRB: Institutional Review Board
IM-ADAPT: Intervention Mapping to Adapt Evidence-Based Interventions
KII: Key Informant Interview
NCDs: Non-Communicable Diseases
PEN: Package of Essential NCDs
PHC: Primary Healthcare
SMRC: Self-Management Resource Center
T2D: Type 2 Diabetes
WHO: World Health Organization

Supplementary files
Supplementary File 1: Stakeholder's feedback and opinion collection format (Page 15)
Supplementary File 2: Basic characteristics of identified diabetes self-management education and support interventions or programs. (Page 19)
Supplementary File 3: Stanford Self-Management Resource Center's Diabetes Self-Management Workshop Overview. (Page 22)
Supplementary File 4: Adaptations made to the original DSMP and features of the adapted E-DSMP for a primary healthcare setup in Ethiopia. (Page 23)

References
1. Educators, A.A.o.D., *An effective model of diabetes care and education: revising the AADE7 Self-Care Behaviors®.* The Diabetes Educator, 2020. **46**(2): p. 139-160.
2. Ethiopia, M.o.H., *National non-communicable diseases management protocols. Addis Ababa, Ethiopia.* . November, 2021.
3. Gebreyohannes, E.A., A.K. Netere, and S.A. Belachew, *Glycemic control among diabetic patients in Ethiopia: a systematic review and meta-analysis.* PLoS One, 2019. **14**(8): p. e0221790.
4. Fasil, A., B. Biadgo, and M. Abebe, *Glycemic control and diabetes complications among diabetes mellitus patients attending at University of Gondar Hospital, Northwest Ethiopia*. Diabetes, metabolic syndrome and obesity: targets and therapy, 2019. **12**: p. 75.
5. Kassahun, T., et al., *Diabetes related knowledge, self-care behaviours and adherence to medications among diabetic patients in Southwest Ethiopia: a cross-sectional survey.* BMC endocrine disorders, 2016. **16**(1): p. 28.
6. Fiseha, T., et al., *Factors associated with glycemic control among diabetic adult out-patients in Northeast Ethiopia.* BMC research notes, 2018. **11**(1): p. 316.
7. Tekalegn, Y., et al., *Magnitude of glycemic control and its associated factors among patients with type 2 diabetes at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.* PloS one, 2018. **13**(3): p. e0193442.
8. Belay, E., et al., *Achievements of Diabetes Goals and Their Determinants in Type 2 Diabetic Patients Attending Outpatient Diabetic Clinic in Northern Ethiopia.* International journal of chronic diseases, 2017. **2017**.
9. Yigazu, D.M. and T.A. Desse, *Glycemic control and associated factors among type 2 diabetic patients at Shanan Gibe Hospital, Southwest Ethiopia.* BMC research notes, 2017. **10**(1): p. 597.

10. Aklilu, T., et al., *Diabetic Patients' Knowledge of Their Disease, Therapeutic Goals, and Self-management: Association With Goal Attainment at Dessie Referral Hospital, Ethiopia.* Therapeutic innovation & regulatory science, 2014. **48**(5): p. 583-591.
11. Abebe, S.M., et al., *Diabetes mellitus in North West Ethiopia: a community based study.* BMC public health, 2014. **14**(1): p. 97.
12. Cheneke, W., et al., *Assessment of glycemic control using glycated hemoglobin among diabetic patients in Jimma University specialized hospital, Ethiopia.* BMC research notes, 2016. **9**(1): p. 96.
13. Organization, W.H., *WHO package of essential noncommunicable (PEN) disease interventions for primary health care.* 2020.
14. Lynch, E.B., et al., *Design of the Lifestyle Improvement through Food and Exercise (LIFE) study: A randomized controlled trial of self-management of type 2 diabetes among African American patients from safety net health centers.* Contemporary clinical trials, 2014. **39**(2): p. 246-255.
15. Deakin, T., et al., *Structured patient education: the Diabetes X-PERT Programme makes a difference.* Diabetic medicine, 2006. **23**(9): p. 944-954.
16. Davies, M.J., et al., *Effectiveness of the diabetes education and self management for ongoing and newly diagnosed (DESMOND) programme for people with newly diagnosed type 2 diabetes: cluster randomised controlled trial.* Bmj, 2008. **336**(7642): p. 491-495.
17. Sturt, J., et al., *Effects of the Diabetes Manual 1: 1 structured education in primary care.* Diabetic Medicine, 2008. **25**(6): p. 722-731.
18. Prezio, E.A., et al., *Community Diabetes Education (CoDE) for uninsured Mexican Americans: a randomized controlled trial of a culturally tailored diabetes education and management program led by a community health worker.* Diabetes research and clinical practice, 2013. **100**(1): p. 19-28.
19. Peña-Purcell, N.C., et al., *Translating an evidence-based diabetes education approach into rural African-American communities: the "wisdom, power, control" program.* Diabetes Spectrum, 2015. **28**(2): p. 106-115.
20. Ko, S.H., et al., *Long-term effects of a structured intensive diabetes education programme (SIDEP) in patients with Type 2 diabetes mellitus—a 4-year follow-up study.* Diabetic medicine, 2007. **24**(1): p. 55-62.
21. Trento, M., et al., *Rethink Organization to iMprove Education and Outcomes (ROMEO) A multicenter randomized trial of lifestyle intervention by group care to manage type 2 diabetes.* Diabetes care, 2010. **33**(4): p. 745-747.
22. Yoo, J.-S., et al., *The effect of a comprehensive lifestyle modification program on glycemic control and body composition in patients with type 2 diabetes.* Asian Nursing Research, 2007. **1**(2): p. 106-115.
23. Adachi, M., et al., *Effects of lifestyle education program for type 2 diabetes patients in clinics: a cluster randomized controlled trial.* BMC public health, 2013. **13**(1): p. 1-14.
24. Kate Lorig, et al. *Diabetes Self-Management Program. An Evidence-Based Self-Management Workshop, Originally Developed at Stanford University.LEADER'S MANUAL*. 2021 [cited 2024 4/21/2024]; Available from: https://selfmanagementresource.com/programs/small-group/diabetes-self-management-small-group/.
25. Moore, G., et al., *Adapting interventions to new contexts—the ADAPT guidance.* bmj, 2021. **374**.
26. Highfield, L., et al., *Intervention mapping to adapt evidence-based interventions for use in practice: increasing mammography among African American women.* BioMed research international, 2015. **2015**.
27. Wiltsey Stirman, S., A.A. Baumann, and C.J. Miller, *The FRAME: an expanded framework for reporting adaptations and modifications to evidence-based interventions.* Implementation Science, 2019. **14**: p. 1-10.
28. Yimer, Y.S., et al., *Patients and healthcare providers needs and challenges in diabetes self-management and support in Ethiopian primary healthcare context.* BMC Health Services Research, 2025. **25**(1): p. 774.
29. Chambers, D.A. and W.E. Norton, *The adaptome: advancing the science of intervention adaptation.* American journal of preventive medicine, 2016. **51**(4): p. S124-S131.
30. McLeroy, K.R., et al., *An ecological perspective on health promotion programs.* Health education quarterly, 1988. **15**(4): p. 351-377.
31. Lorig, K., et al., *Community-based peer-led diabetes self-management.* The diabetes educator, 2009. **35**(4): p. 641-651.
32. Klug, C., D.J. Toobert, and M. Fogerty, *Healthy changes™ for living with diabetes.* The Diabetes Educator, 2008. **34**(6): p. 1053-1061.
33. Flores-Luevano, S., et al., *Impact of a culturally tailored diabetes education and empowerment program in a Mexican American population along the US/Mexico border: a pragmatic study.* Journal of clinical medicine research, 2020. **12**(8): p. 517.
34. Baig, A.A., et al., *Picture good health: a church-based self-management intervention among Latino adults with diabetes.* Journal of general internal medicine, 2015. **30**: p. 1481-1490.
35. LITCHMAN, M.L., et al., *474-P: Durable Reductions in A1C and Diabetes Distress with a One-Day Hybrid DSMES Intervention.* Diabetes, 2021. **70**(Supplement_1).
36. Thoolen, B., et al., *Beyond good intentions: the development and evaluation of a proactive self-management course for patients recently*

diagnosed with type 2 diabetes. Health education research, 2008. **23**(1): p. 53-61.
37. Jalilian, F., et al., *Effectiveness of self-management promotion educational program among diabetic patients based on health belief model.* Journal of education and health promotion, 2014. **3**(1): p. 14.
38. Coppell, K.J., et al., *Nutritional intervention in patients with type 2 diabetes who are hyperglycaemic despite optimised drug treatment—Lifestyle Over and Above Drugs in Diabetes (LOADD) study: randomised controlled trial.* Bmj, 2010. **341**.
39. Ku, G.M.V. and G. Kegels, *Effects of the First Line Diabetes Care (FiLDCare) self-management education and support project on knowledge, attitudes, perceptions, self-management practices and glycaemic control: a quasi-experimental study conducted in the Northern Philippines.* BMJ open, 2014. **4**(8): p. e005317.
40. Bandura, A., *Social foundations of thought and action.* Englewood Cliffs, NJ, 1986. **1986**(23-28): p. 2.
41. *Federal Government of Ethiopia, Ministry of Health, Ethiopian Public Health Institute (2022). Ethiopia: Food-Based Dietary Guidelines–2022. Addis Ababa, Ethiopia*.
42. Houston, T.U.o.T.H.S.C.a. *IM-Adapt Online* 2015; Available from: ttps://imadapt.org/#/what-is-im-adapt
43. Muchiri, J.W., G.J. Gericke, and P. Rheeder, *Adapting a diabetes nutrition education programme for adults with type 2 diabetes from a primary to tertiary healthcare setting.* South African Journal of Clinical Nutrition, 2021. **34**(1): p. 9-17.
44. Choi, S.-Y. and M.-S. Song, *Behavior change theories in diabetes self-management: a conceptual review.* Perspectives in Nursing Science, 2010. **7**(1): p. 1-9.
45. Letta, S., et al., *Barriers to diabetes patients' self-care practices in Eastern Ethiopia: A qualitative study from the health care providers perspective.* Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy, 2021. **14**: p. 4335.
46. Jaafaripooyan, E., et al., *The magnitude, types, and roles of social support in diabetes management among diabetics' in southern ethiopia: a multilevel, multicenter cross-sectional study.* Diabetes, Metabolic Syndrome and Obesity, 2021: p. 4307-4319.
47. McKleroy, V.S., et al., *Adapting evidence–based behavioral interventions for new settings and target populations.* AIDS Education & Prevention, 2006. **18**(supp): p. 59-73.

Supplementary File 1: Stakeholder's opinion data collection format on adapting the SMRC-DSMP to a primary healthcare setup in Ethiopia

- Role of the Participant:
- Diabetes patient
- Clinician/HCPs
- NCD Program Office
- Researcher
- Any other, specify
- Age
- Gender

Instruction

- Before starting asking respondents opinion, read or explain the following background information to the respondent and let them understand the program.
- Hereunder we present characteristics of the original Stanford –DSMP in the first column. Please provide your suggestion/comments/ on the second column on what could or could not work and how better that can be modified for the Ethiopian primary healthcare context. In the third column please provide your rationale for any modification you made. Mark any components that might still be effective for Ethiopia with the phrase "No change."

Background

- **Objective of the current study:** This study aimed to adapt the Stanford-DSMP for T2DM patients at PHC setup in Ethiopia.
- The Diabetes Self-Management Program (DSMP) is an evidence based programs that has been rigorously tested in controlled settings, proven effective, and translated into practical models.
- The Program is designed to help adults who have T2D control their A1C's and reduce the complications associated with DM.
- The DSMP is a 6-week Program to be offered for 2.5 hours weekly by two trained peer leaders.
- Topics covered in the DSMP include an overview of self-management and diabetes, healthy eating, physical activity, monitoring blood glucose, preventing complications, and working with a health care team.
- The Program is highly interactive, with an emphasis on action planning and problem solving. It uses skill building, goal setting, role modeling, and reinforcement with the goal of enhancing participants' self-efficacy.
- The SMRC-DSMP was originally tested and is being implemented in community settings such as churches and senior centers (elderly care homes).

Program Characteristics	**Original Stanford-DSMP (S-DSMP)**	**Adaptations for E-DSMP**	**Rationale/consideration**
Setting	Community setup (senior centers (elderly care homes); wellness center, church)	Prob. if the respondent would suggest any other appropriate setup or place	
Format	A 2:30 hours per session face to face small group (8-16 people) workshop/session	Prob. Any modality other than face to face they prefer or suggest. Prob. Whether the time allocated is convenient for the participant, if not why? And what appropriate time they could suggest per session.	
Workshop Leaders	Two trained leaders by SMRC-Certified Master Trainers , one or both of whom were non-health professionals with diabetes themselves	Prob. Who could be the appropriate facilitator for this workshop in our setup? Why? HCPs, patients, trained volunteers, CHWs, etc..	
Space /Time	A room big enough to comfortably accommodate 8-16 trainees plus two trainers at any convenient place and break out space	Prob. Any available space/room/ for the workshop in the proposed setup or any suggestions?	
Workshop Sessions	**Session One (2:30)** Activity 1: Introduction to the Workshop (20 minutes) Activity 2: Group Introductions (30 minutes) Activity 3: What is Diabetes? (10 minutes) **Break** (20 minutes) Activity 4: Monitoring (25 minutes) Activity 5: Introduction to Healthy Eating (15 minutes) Activity 6: Introduction to Action Plans (25 minutes) Activity 7: Closing (5 minutes)	Prob: relevance, appropriateness, and adequacy of time allocation for each content and any other suggestions (i.e addition, subtraction…) Prob. Any appropriate strategies/teaching aid/guideline to deliver the session Prob. How best they can develop and implement an action plan (timing , content,	

	Session Two (2:30) Activity 1: Feedback and Problem-Solving (30 minutes) Activity 2: 10 Guidelines for a Healthy Eating Plan- review the principles of healthy eating (35 minutes) **Break** (20 minutes) Activity 3: Menu Planning (30 minutes) Activity 4: Dealing with Stress (10 minutes) Activity 5: Making an Action Plan (20 minutes) Activity 6: Closing (5 minutes)	Prob: relevance, appropriateness, and adequacy of time allocation for each content and any other suggestions (i.e addition, subtraction…) Mention the 10 principles of healthy eating and ask whether they are applicable in our set-up or not? Prob. how and why? Prob. Applicability of portion size (amount on the plate - what your guest will eat), number of servings for each portion or ask for any other option for menu planning?	
	Session Three (2:20) Activity 1: Feedback (20 minutes) Activity 2: Preventing Low Blood Sugar (20 minutes) Activity 3: Focusing on Fat (20 minutes) Break (20 minutes) Activity 4: Preventing or Delaying Complications (15 minutes) Activity 5: Making Decisions (25 minutes) Activity 6: Introduction to Physical Activity and Exercise (15 minutes) Activity 7: Making an Action Plan (20 minutes) Activity 8: Closing (5 minutes)	Prob: relevance, appropriateness, and adequacy of time allocation for each content and any other suggestions (i.e addition, subtraction…) Prop. How best we measure/understand the amount of fat in local food/meal Prob. How best DM patients can do PA (when, how and what is required?)	
	Session Four (2:10) Activity 1: Feedback (15 minutes) Activity 2: Dealing with Difficult Emotions (35 minutes) Activity 3: Food Choices (20 minutes) Break (20 minutes) Activity 4: Menu Planning (30 minutes) Activity 5: Making an Action Plan (20 minutes) Activity 6: Closing (10 minutes)	Prob: relevance, appropriateness, and adequacy of time allocation for each content and any other suggestions (i.e addition, subtraction…) Prob. How best DM patients read and understand the main nutrition facts on food labels (food label reading)	
	Session Five (2:30) Activity 1: Feedback (15 minutes) Activity 2: Dealing with Depression (15 minutes) Activity 3: Communicating with Ourselves (20 minutes) Activity 4: Relaxation Body Scan (15 minutes) Break (20 minutes) Activity 5: Communication Skills (25 minutes)	Prob: relevance, appropriateness, and adequacy of time allocation for each content and any other suggestions (i.e addition, subtraction…) Prob. Acceptability and practicability of relaxation body scan as a stress management technique	

	Activity 6: Endurance Activity: How much is enough? (20 minutes) Activity 7: Making an Action Plan (15 minutes) Activity 8: Closing (5 minutes)		
	Session Six (2:30) Activity 1: Feedback (20 minutes) Activity 2: Strategies for Sick Days (15 minutes) Activity 3: Foot Care (15 minutes) Break (20 minutes) Activity 4: Medication Usage (20 minutes) Activity 5: Working with Your Health Care Professional and Health Care Organization (25 minutes) Activity 6: Looking Back and Planning for the Future (25 minutes) Activity 7: Closing (10 minutes	Prob: relevance, appropriateness, and adequacy of time allocation for each content and any other suggestions (i.e addition, subtraction…) Prob. How they can continue the program sustainably	
Homework Assignments and materials	Monitoring blood sugar on 2 days, 1 work day & one non-work day once in AM before eating, once 2 hours after a meal & once after exercising taking note of what we eat and food labels, Keep track of the physical activities we did Action planning and performing Making Decisions Reading book chapter	Prob: relevance, appropriateness for each content and any other suggestions (i.e addition, subtraction…) Prob. Any challenge or opportunity related to the home work activities (for example how frequent they can monitor their blood glucose, access to testing, where? The ability and access to read and understand book chapter.	
We thank you very much for your time and valued feedback!			

Supplementary File 2: Basic characteristics of identified diabetes self-management education and support interventions or programs.

Name of the Program	Origin	Target Population	Provider	Format	Duration	Setting	Showed Effectiveness on HbA1c (Yes, No)
Self-management resource center- diabetes self-management program [1, 2]	USA	T2D	Trained peer leaders	In-person, group based	6 weeks	Community setting	Yes
Healthy Changes for Living with Diabetes[3]	USA	T2D	Trained peer leaders	In-person, group based	6 months	Community setting	NA
Community Diabetes Education (CoDE) program [4],	USA	T2D	CHW-lead	In-person, group based	12 months	Community setting	Yes
Diabetes Education and Empowerment Program (DEEP) [5],	USA	T2D	Diabetes health care team (CHW, HE, research assistant)	In-person, group based	4-8 weeks	Clinic-based	Yes
The "Wisdom, Power, Control" Program [6]	USA	T2D	Interdisciplinary diabetes specialists	In-person, group based	7 weeks	Community setting	No
Lifestyle Improvement through Food and Exercise (LIFE) intervention [7]	USA	T2D	Registered dietitian	In-person, group based	12 months	Community setting	Yes
Diabetes One Day (D1D) Program [8]	US	Diabetes	Interdisciplinary team (nurse practitioner/endocrinologist, pharmacist, dietitian, nurse, and/or exercise specialist)	In-person, Hybrid	over 8 hours in 1 day	Hospital based	Yes
Diabetes Education and Self-Management for Ongoing and Newly Diagnosed (DESMOND) [9]	UK	T2D	Healthcare professional educators	In-person, group based	6-hours	Community setting	No
Picture Good Health [10]	USA	T2D	Trained lay leaders	In-person, group based	8 weeks	Church based	No

Diabetes X-PERT Programme [11]	UK	T2D	Diabetes research dietitian	In-person, group based	6-week	Community setting	Yes
Diabetes Manual 1:1 structured education [12]	UK	T2D	Practice nurses	In-person, telephone, Hybrid	12 weeks	Primary healthcare setting	No
Beyond Good Intentions [13]	Nethe rlands	T2D	Registered nurse	In-person, Hybrid	12 weeks	Clinic Based	NA
Self-Management Promotion Educational Program [14]	Iran	T2D	Research team	In-person, group based	6 weeks	Rural Health center	NA
Structured Intensive Diabetes Education Programme (SIDEP) [15]	South Korea	T2D	Health care team	In-person, group based	6 h per day for 5 days	Hospital Inpatient	Yes
Rethink Organization to iMprove Education and Outcomes (ROMEO) intervention [16]	Italy	T2D	Trained trial investigators	In-person, Hybrid	2 years	Diabetes clinics	Yes
Comprehensive Lifestyle Modification Program (CLMP) [17]	South Korea	T2D	Nurses, registered dietician	In-person, Hybrid	13 months	Clinic based	Yes
Structured Individual-based Lifestyle Education (SILE) program [18].	Japan	T2D	Registered dietician	In-person, Individualized	6 months	Primary care Clinic	Yes
Lifestyle Over and Above Drugs in Diabetes (LOADD) [19]	New Zeala nd	T2D	study dietitian	In-person, Individualized	Six months	University setup	Yes
First Line Diabetes Care (FiLDCare) self-management education and support program [20]	Philip pines	T2D	Government healthcare personnel and village health workers	In-person, individualized	At least once every 3 months for one year	Health stations And home based	Yes
Hybrid = Group +individualized intervention. T2D: Type two diabetes;							

References

1. Lorig, K., et al., *Community-based peer-led diabetes self-management.* The diabetes educator, 2009. **35**(4): p. 641-651.

2. Kate Lorig, et al. *Diabetes Self-Management Program. An Evidence-Based Self-Management Workshop, Originally Developed at Stanford University.LEADER'S MANUAL*. 2021 [cited 2024 4/21/2024]; Available from: https://selfmanagementresource.com/programs/small-group/diabetes-self-management-small-group/.

3. Klug, C., D.J. Toobert, and M. Fogerty, *Healthy changes™ for living with diabetes.* The Diabetes Educator, 2008. **34**(6): p. 1053-1061.

4. Prezio, E.A., et al., *Community Diabetes Education (CoDE) for uninsured Mexican Americans: a randomized controlled trial of a culturally tailored diabetes education and management program led by a community health worker.* Diabetes research and clinical practice, 2013. **100**(1): p. 19-28.

5. Flores-Luevano, S., et al., *Impact of a culturally tailored diabetes education and empowerment program in a Mexican American population along the US/Mexico border: a pragmatic study.* Journal of clinical medicine research, 2020. **12**(8): p. 517.

6. Peña-Purcell, N.C., et al., *Translating an evidence-based diabetes education approach into rural African-American communities: the "wisdom, power, control" program.* Diabetes Spectrum, 2015. **28**(2): p. 106-115.

7. Lynch, E.B., et al., *Design of the Lifestyle Improvement through Food and Exercise (LIFE) study: A randomized controlled trial of self-management of type 2 diabetes among African American patients from safety net health centers.* Contemporary clinical trials, 2014. **39**(2): p. 246-255.

8. LITCHMAN, M.L., et al., *474-P: Durable Reductions in A1C and Diabetes Distress with a One-Day Hybrid DSMES Intervention.* Diabetes, 2021. **70**(Supplement_1).

9. Davies, M.J., et al., *Effectiveness of the diabetes education and self management for ongoing and newly diagnosed (DESMOND) programme for people with newly diagnosed type 2 diabetes: cluster randomised controlled trial.* Bmj, 2008. **336**(7642): p. 491-495.

10. Baig, A.A., et al., *Picture good health: a church-based self-management intervention among Latino adults with diabetes.* Journal of general internal medicine, 2015. **30**: p. 1481-1490.

11. Deakin, T., et al., *Structured patient education: the Diabetes X-PERT Programme makes a difference.* Diabetic medicine, 2006. **23**(9): p. 944-954.

12. Sturt, J., et al., *Effects of the Diabetes Manual 1: 1 structured education in primary care.* Diabetic Medicine, 2008. **25**(6): p. 722-731.

13. Thoolen, B., et al., *Beyond good intentions: the development and evaluation of a proactive self-management course for patients recently diagnosed with type 2 diabetes.* Health education research, 2008. **23**(1): p. 53-61.

14. Jalilian, F., et al., *Effectiveness of self-management promotion educational program among diabetic patients based on health belief model.* Journal of education and health promotion, 2014. **3**(1): p. 14.

15. Ko, S.H., et al., *Long-term effects of a structured intensive diabetes education programme (SIDEP) in patients with Type 2 diabetes mellitus—a 4-year follow-up study.* Diabetic medicine, 2007. **24**(1): p. 55-62.

16. Trento, M., et al., *Rethink Organization to iMprove Education and Outcomes (ROMEO) A multicenter randomized trial of lifestyle intervention by group care to manage type 2 diabetes.* Diabetes care, 2010. **33**(4): p. 745-747.

17. Yoo, J.-S., et al., *The effect of a comprehensive lifestyle modification program on glycemic control and body composition in patients with type 2 diabetes.* Asian Nursing Research, 2007. **1**(2): p. 106-115.

18. Adachi, M., et al., *Effects of lifestyle education program for type 2 diabetes patients in clinics: a cluster randomized controlled trial.* BMC public health, 2013. **13**(1): p. 1-14.

19. Coppell, K.J., et al., *Nutritional intervention in patients with type 2 diabetes who are hyperglycaemic despite optimised drug treatment—Lifestyle Over and Above Drugs in Diabetes (LOADD) study: randomised controlled trial.* Bmj, 2010. **341**.

20. Ku, G.M.V. and G. Kegels, *Effects of the First Line Diabetes Care (FiLDCare) self-management education and support project on knowledge, attitudes, perceptions, self-management practices and glycaemic control: a quasi-experimental study conducted in the Northern Philippines.* BMJ open, 2014. **4**(8): p. e005317.

Supplementary File 3: Stanford Self-Management Resource Center's Diabetes Self-Management Workshop Overview

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Overview of self-management and diabetes	●					
Nutrition/Healthy Eating	●	●	●	●		
Making an action plan	●	●	●	●	●	
Monitoring diabetes and blood sugar	●	●	●	●	●	●
Problem-solving		●	●	●	●	●
Feedback		●	●	●	●	●
Dealing with stress		●				
Preventing low blood sugar			●			
Preventing complications			●			
Making decisions			●			
Physical activity / exercise			●		●	
Difficult emotions				●		
Depression					●	
Positive thinking					●	
Relaxation techniques					●	
Communication					●	
Sick days						●
Foot care						●
Medication						●
Working with your health care professional and health care system						●
Future plans						●

Supplementary File 4: Adaptations made to the original DSMP and features of the adapted E-DSMP to a primary healthcare setup in Ethiopia.

Program Characteristics	**Original Stanford-DSMP (S-DSMP)**	**Adaptations for E-DSMP**	**Rationale/consideration**
Targeted Participants	All adult patients with type 2 diabetes	Newly diagnosed and patients with uncontrolled T2D and/or their family supporter.	• To fit the existing program and increase acceptability. • According to the WHO-PEN and National NCD Management Protocol, lifestyle modification was recommended in the first 3 months of diagnosis. • Since most T2D patients in the new set-up were illiterate and elderly, involving family supporter has been recommended.
Format	A 2:30 hours per session face to face small group (8-16 people) workshop/session	Group-based (10-15 individuals) in average 2:25 hours per session for 6 weeks	• For efficient utilization of resources, we increased the minimum number of participants in a group.
Workshop Leaders	Two trained leaders by SMRC-Certified Master Trainers, one or both of whom were non-health professionals with diabetes themselves	One trained HCPs by SMRC-Certified Master Trainers and one peer leader selected from participants with some pre orientation by a trained leader.	• Resource constraints to train two leaders, furthermore peer leader may not be fully competent given low health literacy in Ethiopia.
Space /Time	A room big enough to comfortably accommodate 8-16 trainees plus two trainers at any convenient place and break out space Schedule workshops for the convenience of the	Use existing conference/ meeting halls at PHC. Schedule workshops for the convenience of majority of the cohorts including weekends	• Appropriate space is not available at the community setup. • Increase convenience for Workshop leaders/HCPs

	participants		• Integration with existing WHO-PEN and national NCD management protocols
Workshop Sessions	**Session One (2:30)** Activity 1: Introduction to the Workshop (20 minutes) Activity 2: Group Introductions (30 minutes) Activity 3: What is Diabetes? (10 minutes) **Break** (20 minutes) Activity 4: Monitoring (25 minutes) Activity 5: Introduction to Healthy Eating (15 minutes) Activity 6: Introduction to Action Plans (25 minutes) Activity 7: Closing (5 minutes)	**Session One (2:30)** • Activity 1: Introduction to the Workshop (20 minutes) • Activity 2: Introduction to general principles/techniques of self-management for diabetes (10 minutes) • Activity 3: What is Diabetes and some misconceptions? (30 minutes) • Break : 20 minutes • Activity 4: Blood glucose monitoring (20 minutes) • Activity 5: Introduction to Healthy Eating (20 minutes) • Activity 6: Introduction to Action Plans (20 minutes) • Activity 7: Closing (10 minutes)	• We included common misconceptions about diabetes in Activity 3, as these were identified as a significant determinant in the new setting.
	Session Two (2:30) Activity 1: Feedback and Problem-Solving (30 minutes) Activity 2: Guidelines for a Healthy Eating Plan (35 minutes) **Break** (20 minutes) Activity 3: Menu Planning (30 minutes) Activity 4: Dealing with Stress (10 minutes) Activity 5: Making an Action Plan (20 minutes) Activity 6: Closing (5 minutes)	**Session Two (2:20)** • Activity 1: Feedback and Problem-Solving (30 minutes) • Activity 2: Guidelines for a Healthy Meal and Healthy Eating Plan (30 minutes) • Break : 20 minutes • Activity 3: Dealing with Stress and Difficult Emotions (35 minutes • Activity 4: Making an Action Plan (20 minutes) • Activity 5: Closing (5 minutes)	• Guidelines for a healthy meal modified according to Ethiopia: Food-Based Dietary Guidelines and the plate method. • Menu planning was removed from Session 2 and presented solely in Session 4. Instead, we introduced the topic of food choices in Session 2 to provide some foundational lessons for menu planning. • We bring the topic of difficult

			emotions here, as stress and difficult emotions are related, and to minimize redundancy.
	Session Three (2:20) Activity 1: Feedback (20 minutes) Activity 2: Preventing Low Blood Sugar (20 minutes) Activity 3: Focusing on Fat (20 minutes) Break (20 minutes) Activity 4: Preventing or Delaying Complications (15 minutes) Activity 5: Making Decisions (25 minutes) Activity 6: Introduction to Physical Activity and Exercise (15 minutes) Activity 7: Making an Action Plan (20 minutes) Activity 8: Closing (5 minutes)	**Session Three (2:20)** • Activity 1: Feedback and problem-solving (20 minutes) • Activity 2: Preventing low blood sugar and complications (35 minutes) • Activity 3: Introduction to Physical Activity and Exercise (15 minutes) • Break : 20 minutes • Activity 4: Endurance Activity: How much is enough? (25 minutes) • Activity 5: Making an Action Plan (20 minutes) • Activity 6: Closing (5 minutes)	• The session on fat has been replaced with food choices and included in Session 2, as fat consumption is rare, and not applicable in the new setting. • The topic of making decisions has been shifted to Session 5, replacing the topic of Endurance Activity: How Much is enough? Which is included here to be covered alongside Physical Activity and Exercise.
	Session Four (2:10) Activity 1: Feedback (15 minutes) Activity 2: Dealing with Difficult Emotions (35 minutes) Activity 3: Food Choices (20 minutes) Break (20 minutes) Activity 4: Menu Planning (30 minutes) Activity 5: Making an Action Plan (20 minutes) Activity 6: Closing (10 minutes)	**Session Four (2:10)** • Activity 1: Feedback and problem-solving (20 minutes) • Activity 2: Menu planning practical exercise (1 hours) • Break: 20 minutes • Activity 3: Making an action plan (20 minutes) • Activity 4: Summary, homework and closing (10 minutes)	• The topic of managing difficult emotions was shifted to Session 2, where it was integrated with stress management. • The food choices session was moved to Session 3, replacing the focus on fat. • As part of menu planning, carbohydrate counting and reading

			food labels were dropped. • The guidelines for a healthy meal were modified according to Ethiopia: Food-Based Dietary Guidelines and the Plate Methods. • Example of menu changed to local meals • We included a practical session on menu planning to showcase meal planning using locally available food options.
	Session Five (2:30) Activity 1: Feedback (15 minutes) Activity 2: Dealing with Depression (15 minutes) Activity 3: Communicating with Ourselves (20 minutes) Activity 4: Relaxation Body Scan (15 minutes) Break (20 minutes) Activity 5: Communication Skills (25 minutes) Activity 6: Endurance Activity: How much is enough? (20 minutes) Activity 7: Making an Action Plan (15 minutes) Activity 8: Closing (5 minutes)	**Session Five (2:35)** • Activity 1: Feedback and Problem-Solving (20 minutes) • Activity 2: Making Decisions (25 minutes)) • Activity 3: Dealing with Depression (20 minutes • Break : 20 minutes • Activity 4: Communicating with Ourselves (20 minutes) • Activity 5: Communication Skills (25 minutes) • Activity 6: Making an Action Plan (20 minutes) • Activity 7: Closing (5 minutes)	• We removed the topic of relaxation body scan due to cultural and religious sensitivities, as it is associated with the religious practices of other groups. • The topic of Endurance Activity: How Much is enough, has been moved to Session 3, replacing the topic of Making Decisions, which is now included in this session.
	Session Six (2:30) Activity 1: Feedback (20 minutes)	**Session Six (2:25)** • Activity 1: Feedback and Problem-Solving (20 minutes)	• We incorporated a monthly follow-up for Activity 6, related to future plans,

	Activity 2: Strategies for Sick Days (15 minutes) Activity 3: Foot Care (15 minutes) Break (20 minutes) Activity 4: Medication Usage (20 minutes) Activity 5: Working with Your Health Care Professional and Health Care Organization (25 minutes) Activity 6: Looking Back and Planning for the Future (25 minutes) Activity 7: Closing (10 minutes	• Activity 2: Strategies for Sick Days (10 minutes) • Activity 3: Foot Care (15 minutes) • Activity 4: Medication Usage (30 minutes) • Break : 20 minutes • Activity 5: Working with your Health Care Professional and Health Care Organization (15minutes) • Activity 6: Looking Back and Planning for the Future (30 minutes) • Activity 7: Closing (5minutes)	via phone call for a duration of three months.
Homework Assignments and materials	• Monitoring blood sugar on 2 days, 1 work day & one non-work day once in AM before eating, once 2 hours after a meal & once after exercising • taking note of what we eat and food labels, • Keep track of the physical activities we did • Action planning and performing • Making Decisions • Reading book chapter	• We considered locally appropriate home-take reading materials, such as handbook, and leaflets. • A one-time blood sugar measurement on weeks 1 and 5 is considered applicable in the new setting due to the lack of diagnostic kits and tests. In addition, it is recommended that program organizers provide blood glucose testing at week one and week six, given the limited availability of home glucose monitoring kits in the local setting.	• Diagnostic tests and kits were not easily available and affordable in the new setup • Accessing the book “Living a Healthy Life with Chronic Conditions” is not affordable and not feasible in the new context. • limited availability of home glucose monitoring kits in the local setting.