Nurse-Led Diabetes Self-Management Education and Self-Care Support in Diabetes Care.

ABSTRACT

Type 2 diabetes mellitus requires sustained self-management to achieve glycemic control and reduce the risk of complications. Because much of diabetes care occurs outside clinical settings, patients must routinely adhere to medication, nutrition, physical activity, blood glucose monitoring, and problem-solving behaviors. Nurses play a central role in supporting these activities through diabetes self-management education (DSME) and diabetes self-management education and support (DSMES). This narrative review examines nurses' contributions to diabetes outcomes through educational, behavioral, and supportive interventions. The available evidence shows that nurse-led DSMES improves diabetes knowledge, self-efficacy, self-care behaviors, medication adherence, and glucose monitoring, with associated reductions in glycated hemoglobin levels. These effects are strongest when education is individualized, reinforced over time, and integrated with counseling, motivational interviewing, behavioral coaching, and follow-up. Digital and telehealth approaches may further extend the reach of nurse-led support, although their effectiveness depends on access, engagement, and professional feedback. Barriers such as workforce constraints, health literacy, socioeconomic disadvantage, cultural differences, and implementation challenges may limit program impact. In conclusion, nurse-led DSMES is an important component of comprehensive diabetes care, supporting long-term self-management and improving patient outcomes.

Keywords: Diabetes Mellitus, Type 2; Self-Management; Patient Education as Topic; Self Care

1 Introduction

Diabetes mellitus is a major global public health challenge, with adult prevalence increasing from approximately 7% in 1990 to 14% in 2022, affecting more than 800 million adults worldwide[1,2]. Despite advances in pharmacological treatment and health-system capacity in many countries, substantial gaps in diabetes care persist, particularly in low- and middle-income regions where screening, treatment coverage, and follow-up remain suboptimal [3].

Beyond its high prevalence, diabetes is characterized by its need for continuous self-management. Effective disease control relies largely on patients' daily decisions regarding dietary habits, medication adherence, glucose monitoring, symptom recognition, and prevention of complications[1,2,4]. These activities occur outside formal healthcare settings and are strongly influenced by health literacy, numeracy, socioeconomic conditions, treatment complexity, family responsibilities, and psychological factors [5]. Deficits in understanding and applying treatment recommendations have been consistently associated with poorer glycemic control and higher complication rates in diverse populations [3,5].

Within this context, nursing assumes a critical role. Unlike interventions focused primarily on biomedical targets, nursing practice directly addresses the behavioral and practical demands of chronic disease management, helping patients integrate recommended self-care activities into everyday life [2,4].

Nurses commonly conduct individualized assessments, deliver tailored education, reinforce behavior change, monitor treatment responses, and coordinate multidisciplinary input across clinic, community, and virtual settings, functions that are central to sustainable self-management support [5,6].

The importance of self-management extends beyond patient education alone. Contemporary evidence indicates that improvements in glycemic outcomes are mediated through enhanced self-

care behaviors, greater self-efficacy, and improved problem-solving abilities. Structured self-management interventions consistently demonstrate that behavioral changes and increased patient confidence contribute substantially to improved diabetes control [2,7].

Multiple meta-analyses have reported clinically meaningful reductions in glycated hemoglobin (HbA1c) following diabetes self-management education (DSME), particularly when programs include behavioral components and sufficient contact time [8–10].

Glycemic control depends not only on medication use but also on education, behavior change, and the organization of ongoing support. The effectiveness of medications depends on patients' ability to understand treatment regimens, recognize glucose patterns, adapt to lifestyle demands, and respond appropriately to symptoms and treatment-related challenges. This perspective provides a strong rationale for nursing involvement, as nurses facilitate the development and maintenance of these essential self-management competencies [5,11].

Through structured assessment, collaborative goal setting, counseling, and longitudinal follow-up, nurses support patients in applying pharmacological prescriptions within the constraints of real-world daily life [5,6].

Nursing contributions to diabetes care extend beyond routine education and encompass continuity of care, individualized coaching, cultural adaptation, accessibility, and ongoing behavioral reinforcement. Through repeated patient contact and sustained support, nurses help translate clinical recommendations into practical actions that can be implemented in daily life.

In many programs, these activities are undertaken in collaboration with dietitians, physicians, and other health professionals as part of interdisciplinary diabetes care teams [5,6].

Evidence from meta-analyses indicates that nurse-led interventions consistently improve self-management behaviors and self-efficacy, with glycemic benefits becoming more pronounced

when interventions are maintained over longer follow-up periods and when contact time is greater [12]. Foundational DSME meta-analyses similarly show that greater contact hours and ongoing reinforcement are associated with larger and more durable reductions in HbA1c[8,9].

This observation is supported by recent implementation studies demonstrating that nurse-led DSMES can be effectively delivered across outpatient, community, and technology-assisted settings while maintaining meaningful improvements in both behavioral and clinical outcomes [13,14].

Nursing involvement is not merely supportive but intrinsically aligned with the requirements of diabetes management. Because successful diabetes care depends on repeated reinforcement, behavioral troubleshooting, and long-term engagement, nursing practice is particularly well suited to outpatient, community-based, virtual, and transitional-care settings where sustained self-management support is required [5,13,15].

Current evidence strongly supports integrating diabetes self-management education (DSME) with ongoing self-care support. Although structured education improves knowledge and initial behavioral change, its benefits may diminish over time without reinforcement[5,16].

Early meta-analyses documented attenuation of HbA1c effects several months after education is discontinued if ongoing support is not provided [8,17]. Consequently, contemporary standards increasingly emphasize diabetes self-management education and support (DSMES) as a comprehensive approach that combines knowledge acquisition with long-term behavioral maintenance [5,6,16].

Recent comparative evidence further supports this integrated approach. In a network meta-analysis involving 108 studies and 17,735 participants, DSMES demonstrated superior effects on

HbA1c, fasting blood glucose, blood pressure, and lipid outcomes compared with usual care and achieved greater glycemic improvement than DSME alone [16].

These findings, together with accumulating evidence from nurse-led interventions and digital programs, underscore the central role of nurses in delivering effective DSMES and justify a focused examination of nurse-led DSME and self-care support in contemporary diabetes care.

DSME provides the knowledge and skills patients need, while self-care support helps them maintain those behaviors in daily practice. This distinction is particularly relevant to nursing practice, as nurses frequently provide ongoing reinforcement, problem-solving support, and behavioral coaching to maintain long-term adherence and self-management [5,16,18].

This narrative review examines the role of nurses in improving diabetes outcomes through diabetes self-management education and sustained self-care support. Particular emphasis is placed on the conceptual foundations of DSME and DSMES, the nursing interventions that facilitate effective self-management, and the mechanisms through which these interventions contribute to long-term behavioral and glycemic improvement among adults with type 2 diabetes.

2 Concept of DSME

2.1 Definition and Evolution from DSME to DSMES

The concept of diabetes self-management education (DSME) has evolved considerably over the past two decades. While earlier literature primarily emphasized education as a means of improving patient knowledge and self-care skills, contemporary standards increasingly recognize that education alone is insufficient to sustain long-term behavioral change.

These findings highlighted the limitations of one-time or brief educational encounters and the need to embed self-management training within continuing care [17,19].

Consequently, the current framework of diabetes self-management education and support (DSMES) integrates structured education with ongoing support to facilitate implementation, maintenance of self-care behaviors, and adaptation to changing clinical circumstances[5,18,20].

Current consensus documents define DSMES as a structured, person-centered process that equips individuals with the knowledge, skills, and confidence required for effective diabetes self-management while providing continuous support for problem-solving, decision-making, and quality-of-life preservation[5,18,20–23].

Although many contemporary intervention studies continue to use the term DSME, their interventions frequently incorporate support elements such as coaching, follow-up contacts, digital reinforcement, and behavioral counseling. As a result, some terminological overlap persists within the literature. Nevertheless, DSMES has become the preferred terminology in current guidelines because it more accurately reflects the longitudinal and behavioral nature of diabetes management[12,24].

In practice, DSMES emphasizes an ongoing relationship in which education, skills training, and support are revisited and adapted over time as patients' clinical status, treatment regimens, and life circumstances change [5,6].

2.2 Core Goals of DSME

The primary objectives of DSME/DSMES encompass three interrelated domains: improving diabetes-related knowledge, strengthening self-efficacy, and promoting sustainable self-care behaviors. Effective programs enhance patients' understanding of diabetes and its treatment while supporting practical behaviors related to medication adherence, healthy eating, physical activity, glucose monitoring, foot care, and problem-solving [2,25].

Meta-analyses of theory-based self-management educational interventions have shown that programs grounded in behavioral and social-cognitive theories significantly improve HbA1c, diabetes knowledge, and self-efficacy, reinforcing the centrality of these goals [26].

These goals should be viewed as sequential and complementary rather than independent outcomes. Knowledge provides the foundation for informed decision-making, whereas self-efficacy facilitates translating knowledge into action. Sustained behavioral change ultimately depends on continued support that reinforces self-management practices and reduces the likelihood of behavioral decline over time [5,26].

Sustained behavioral change ultimately depends on continued support that reinforces self-management practices and reduces the likelihood of behavioral decline over time[7–9,12].DSMES operationalizes this sequence by linking educational content, skill-building, and ongoing support within a single, person-centered framework [6].

2.3 Standards, Timing, and Delivery Principles

Contemporary DSMES standards emphasize that self-management support should be delivered throughout the course of diabetes rather than as a single educational event. Current guidelines identify four critical times when DSMES should be assessed, offered, or modified: at diagnosis, annually, when treatment targets are not achieved, and when new complicating factors emerge, as well as during transitions in health status or care settings[5,18].

Systematic review evidence focusing on adults within 12 months of diagnosis further demonstrates that DSMES initiated early in the disease course can improve HbA1c and self-care behaviors, supporting these timing recommendations [27].

Modern DSMES delivery is guided by person-centered care principles that emphasize collaborative goal setting, cultural responsiveness, consideration of social determinants of health,

and individualized behavioral support. Delivery methods have also expanded beyond traditional face-to-face education to include group-based programs, telephone support, remote monitoring, and digital health platforms. These approaches can increase accessibility and patient engagement across diverse populations[24,28].

Meta-analyses indicate that mode of delivery, contact hours, and provider mix influence glycemic outcomes; programs that combine individual and group sessions, provide at least 10–12 hours of contact, and involve interdisciplinary teams (including nurses, dietitians, and other health professionals) tend to achieve larger HbA1c reductions than low-dose, single-provider education [9,10]. However, evidence suggests that technology-based interventions are more effective when combined with professional feedback, coaching, or other forms of individualized support. Therefore, digital tools should be viewed as mechanisms that extend and reinforce DSMES rather than replacements for healthcare professional involvement[24,28,29].

2.4 Why Nurse-Led DSME Is Effective in Clinical Practice

Both theoretical and practical considerations can explain the effectiveness of nurse-led DSME. From a theoretical perspective, nursing practice inherently incorporates patient assessment, health education, behavioral reinforcement, communication, and long-term follow-up, all of which are central components of effective self-management support. From a practical perspective, nurses frequently have greater opportunities than physicians for repeated patient contact, individualized counseling, and ongoing reinforcement across clinical, community, and remote-care settings[12,15]. Consequently, nurse-led DSME should be viewed as a core component within collaborative care frameworks rather than an isolated intervention.

In addition, recent implementation research increasingly recognizes nurse-led diabetes care as a scalable healthcare model capable of expanding access to self-management support, particularly

among vulnerable and underserved populations where specialist diabetes services may be limited [13,14].

2.5 Evidence That Nurse-Led DSME Improves Knowledge, Self-Care, and Glycemic Outcomes

Evidence supporting nurse-led DSME is substantial, though intervention effects vary by program design, duration, and patient population. Improvements in self-efficacy and self-care behaviors are consistently reported, while glycemic outcomes demonstrate moderate but clinically meaningful benefits[12,30–32].

A recent meta-analysis of nurse-led DSME interventions reported reductions in HbA1c of −0.92% at 4–6 months and −0.54% beyond 6 months, accompanied by a large pooled improvement in self-efficacy (SMD 1.48), despite considerable between-study heterogeneity[12].

These findings are supported by broader evidence on DSME/DSMES. A network meta-analysis demonstrated that DSMES reduced HbA1c by −0.61% compared with usual care and achieved modestly greater glycemic improvement than education-only interventions (−0.23%).

Similarly, structured DSME programs in low- and middle-income countries produced pooled HbA1c reductions of −0.64%, while DSMES interventions in the WHO African Region demonstrated a pooled effect size of SMD −0.468[16,25,33].

Collectively, these findings indicate that nurse-led DSME/DSMES improves diabetes knowledge, self-management behaviors, self-efficacy, and glycemic control. The available evidence further suggests that sustained interventions incorporating ongoing support are generally more effective than brief educational encounters alone[12,16,25,33].Evidence of DSME interventions further confirmed a significant overall positive effect on HbA1c while

emphasizing the need for integrated, multimodal self-management programs to maximize long-term effectiveness [34].

3 Nurses' role in self-care support

3.1 Nurses as Translators of Treatment Plans into Daily Routines

Nurses play a pivotal role in diabetes self-management by translating clinical recommendations into practical behaviors that patients can implement and sustain in daily life. Their contribution extends beyond the delivery of information to include assessment of readiness for change, adaptation of education to cultural and literacy needs, identification of barriers to adherence, and ongoing reinforcement of self-care practices[2,12].

In this context, nurses operationalize self-care by helping patients translate therapeutic recommendations into realistic meal plans, medication schedules, glucose-monitoring routines, and contingency strategies to manage disruptions to daily life. Many failures in diabetes management arise not from a lack of medical advice but from difficulties integrating that advice into everyday routines. Through individualized coaching and continuous follow-up, nurses bridge this gap between treatment planning and sustained self-management[2,12].

These translation activities often occur within multidisciplinary teams that include dietitians, physicians, and other health professionals, with nurses frequently acting as coordinators who align clinical plans with patients' daily contexts. Qualitative and implementation studies suggest that this coordinating role is particularly important for patients with multimorbidity or complex treatment regimens, in whom fragmented guidance can otherwise lead to confusion and reduced adherence [13,32,35,36].

3.2 Dietary Guidance and Healthy Eating Education

Dietary counseling remains a core component of nursing support in diabetes care. Contemporary evidence indicates that nutritional guidance is most effective when individualized and aligned with patients' cultural practices, food preferences, financial circumstances, and daily routines. Rather than providing prescriptive instructions alone, nurses facilitate collaborative goal setting and behavioral change strategies that support long-term adherence to healthy eating patterns[2,5].

Nurses also help patients understand the relationship between food choices, meal timing, portion size, and glycemic outcomes. By integrating dietary recommendations into patients' social and environmental contexts, they promote more sustainable lifestyle modifications.

Further evidence from patient-centered interventions further supports this approach. Multicomponent programs incorporating individualized education, counseling, behavioral training, and home-based support have demonstrated significant improvements in self-efficacy and self-care behaviors, accompanied by modest but clinically meaningful reductions in HbA1c[7]. These findings suggest that dietary education is most effective when delivered as an ongoing behavioral coaching process rather than a one-time educational activity.

Many of these programs are delivered by interdisciplinary teams in which nurses play a central but not exclusive role; recognizing this helps avoid overstating the uniqueness of nursing while still highlighting their contribution to day-to-day dietary support [7,32,37].

The evidence suggests that dietary counseling is most effective when integrated into broader behavioral support and tailored to the patient's social and cultural context.

3.3 Medication Adherence Support and Follow-Up

Medication adherence remains a major challenge in type 2 diabetes management. Factors contributing to nonadherence include treatment complexity, medication costs, adverse effects, limited health literacy, misconceptions about therapy, and competing personal or occupational demands[11,38].

Nurses support adherence by explaining treatment regimens, addressing misconceptions, teaching correct medication administration, monitoring adverse effects, and collaborating with prescribers to simplify treatment plans when appropriate. Equally important, they use regular follow-up interactions to identify early signs of adherence difficulties and implement corrective strategies before glycemic control deteriorates[11,38].

Medication adherence support is both educational and relational. While many patients understand the importance of prescribed therapy, they often encounter practical challenges related to work schedules, meal timing, travel, injections, or treatment-related side effects. Nurses are uniquely positioned to address these challenges through individualized problem-solving and ongoing support integrated into routine diabetes care [11].

Similarly, a randomized trial evaluating a personalized nurse-led engagement program reported significant improvements in treatment adherence, self-efficacy, and patient engagement, further supporting the value of individualized follow-up and behavioral coaching in medication management [39].

At the same time, systematic reviews indicate that improvements in adherence measures do not invariably translate into large or sustained changes in glycemic indices, particularly when interventions are brief or low intensity [11,38,40]. This underscores the importance of embedding adherence support within comprehensive DSMES models and of evaluating both

behavioral and clinical outcomes when assessing the impact of nurse-led adherence interventions.

3.4 Blood Glucose Monitoring Teaching and Interpretation

Effective glucose monitoring requires both technical proficiency and interpretive understanding. Nurses educate patients on the use of self-monitoring devices and continuous glucose monitoring systems while also helping them understand how glucose values relate to dietary intake, physical activity, stress, illness, and medication timing[24,41].

The interpretive component of glucose monitoring is particularly important because glucose data become clinically meaningful only when patients can translate readings into informed self-management decisions. Through individualized feedback, nurses help patients recognize patterns, identify triggers of glycemic fluctuations, and modify behaviors accordingly.

Structured nurse-led education programs have also demonstrated significant improvements in blood glucose monitoring behaviors, reinforcing the importance of combining technical instruction with individualized interpretation and feedback [37].

Evidence from digital DSMES interventions further supports the role of nurses in interpreting glucose monitoring results and providing feedback. Programs that combine remote monitoring with professional coaching appear particularly effective in helping patients recognize glycemic patterns and apply monitoring data to self-management decisions [24,42].

However, not all self-monitoring or technology-intensive programs lead to substantial improvements in glycemic outcomes, and benefits appear greatest when monitoring is explicitly linked to treatment adjustment, problem-solving, and structured education rather than performed in isolation. These observations support an emphasis on nurse-led interpretation and action

planning, while detailed clinical outcome effects are best considered in the dedicated clinical and behavioral outcomes section.

3.5 Problem-Solving for Hypoglycemia, Hyperglycemia, Missed Doses, and Lifestyle Barriers

Problem-solving is a fundamental component of effective diabetes self-management support. Patients must frequently adapt to fluctuating glucose levels, missed medications, acute illness, dietary deviations, changing schedules, physical limitations, and psychological stress. Consequently, contemporary diabetes standards identify problem-solving as a core self-management competency[2,5].

Nurses help patients develop adaptive strategies to manage these challenges, promoting resilience and confidence in self-care decision-making. Their role extends beyond preventing errors to assisting patients in responding effectively when setbacks occur.

Evidence from tele-nursing and motivational interviewing interventions supports the value of counseling-based approaches for helping patients manage real-world diabetes challenges and sustain self-management behaviors over time [43].

In practice, these approaches help patients identify specific barriers, discuss readiness for change, and develop realistic action plans for common diabetes-related problems.Evidence indicates that interventions incorporating coaching, motivational support, and repeated patient contact are particularly effective in strengthening adaptive self-management skills. Similarly, digital interventions demonstrate greater effectiveness when combined with personalized professional guidance, while motivational interviewing approaches have shown benefits for both behavioral outcomes and glycemic control[24,44].

Nonetheless, many available trials are relatively small and of limited duration, which limits the ability to draw firm conclusions about long-term effectiveness; this limitation is further addressed in the clinical and behavioral outcomes section.

3.6 Reinforcement of Physical Activity, Foot Care, and Risk Reduction

Risk-reduction behaviors represent a practical extension of diabetes self-care support. Nurses promote regular physical activity, encourage symptom-aware exercise planning, reinforce foot inspection practices, educate patients regarding footwear selection and skin care, and facilitate early recognition of complications requiring medical attention[2,45].

These preventive behaviors are essential because the long-term prevention of diabetes-related complications depends largely on sustained patient engagement in daily self-care activities. However, such behaviors often decline over time without reinforcement and monitoring.

Emerging evidence from diabetic-foot care interventions highlights the value of targeted nurse-led support. A randomized controlled trial evaluating a nurse-led, self-efficacy–based hybrid foot self-management program demonstrated significant improvements in foot-care knowledge, self-care practices, and self-efficacy among individuals with diabetes [46].

Similar improvements in foot-care behaviors have been reported in theory-based nurse-led DSMES interventions that integrate practical skills training, behavioral reinforcement, and continuous follow-up [37,46]. Although focused on a specific complication, these findings support the broader principle that combining education with reinforcement, behavioral feedback, and ongoing support enhances adherence to preventive self-care behaviors.

These findings suggest that nurse-led reinforcement is especially important for complex or low-salience behaviors (such as foot care and routine physical activity) that may not be maintained

without structured support, while detailed clinical outcomes (e.g., ulcer incidence) are more appropriately discussed in the outcomes section.

Overall, nurses contribute substantially to diabetes self-management by integrating education, behavioral coaching, monitoring, and reinforcement into routine care. Through these activities, they help patients translate knowledge into sustained self-care behaviors, ultimately improving both behavioral and clinical outcomes.

Figure 1 summarizes the nurse-led self-care support pathway, illustrating how assessment, education, reinforcement, monitoring, and escalation form a continuous cycle that supports sustained diabetes self-management.

4 Educational strategies used by nurses

Effective diabetes self-management support depends not only on what patients are taught but also on how education is delivered. Contemporary evidence increasingly favors individualized, theory-informed, and multimodal educational approaches over traditional didactic teaching. Current DSMES standards emphasize structured curricula, trained educators, quality assurance, and outcome evaluation as key components of effective educational programs [18,37].

4.1 Individual Education Sessions

Individualized education remains a cornerstone of nurse-led diabetes care, particularly for newly diagnosed patients, individuals with limited health literacy, those receiving complex treatment regimens, or patients facing psychosocial barriers. Personalized educational sessions allow nurses to assess self-care deficits, confidence, readiness for change, and individual barriers, enabling tailored interventions that address specific patient needs rather than providing generic recommendations [39,47].Recent nurse-led interventions support the use of individualized

educational approaches to address treatment-related barriers, strengthen patient engagement, and facilitate personalized self-management planning [39,47].

Such one-to-one encounters are especially important for aligning educational content with patients' cognitive, linguistic, and cultural backgrounds and for initiating collaborative goal-setting that can later be reinforced in group or digital formats. However, they are resource-intensive, and their optimal frequency and integration with other DSMES components remain areas for further study[12,18,34], which are addressed in more detail when clinical and behavioral outcomes are considered.

4.2 Group Teaching and Peer Support

Group-based education remains an important strategy within DSME and DSMES programs. Beyond improving efficiency, group teaching creates opportunities for peer interaction, shared learning, normalization of challenges, and mutual accountability. These psychosocial benefits may enhance motivation and long-term engagement in self-management activities [48,49].

Evidence suggests that peer-supported DSME interventions can improve glycemic outcomes, particularly when contact is frequent and integrated within structured education programs. A meta-analysis of peer-support interventions reported a pooled HbA1c improvement of SMD −0.41, with stronger effects observed in interventions characterized by frequent contact, shorter program duration, and active group participation [50]. Consequently, group-based education should be viewed not only as a resource-efficient teaching method but also as a mechanism for strengthening social support and behavioral maintenance.

Earlier evıdence of group-based DSME similarly highlights improvements in knowledge, self-management skills, and selected cardiometabolic risk factors, supporting the integration of group formats within comprehensive DSMES models[25,48,49].At the same time, findings on long-

term durability beyond 12 months are mixed, underscoring the need for ongoing reinforcement and follow-up outside the initial group program.

4.3 Counseling and Motivational Interviewing

Counseling-based interventions have become increasingly important within nurse-led diabetes education. Motivational interviewing and other patient-centered counseling approaches are particularly valuable for addressing ambivalence, strengthening self-efficacy, reducing diabetes-related distress, and facilitating long-term behavior change.

Recent evidence supports tele-nursing motivational interviewing as an effective strategy for promoting behavior change, strengthening patient engagement, and addressing barriers to self-management [43,51]. Broader evidence further supports the effectiveness of motivational interviewing in improving behavioral outcomes and glycemic control in adults with type 2 diabetes [43,44,52,53]. These findings suggest that educational interventions are most effective when they actively engage patients in behavior change rather than relying solely on information transfer.

This reinforces the view that counseling and motivational interviewing should be positioned as complementary components within DSMES, with their detailed impact on clinical endpoints described in the clinical and behavioral outcomes section.

4.4 Demonstrations, Printed Materials, and Culturally Appropriate Teaching

Practical demonstrations and skills rehearsal are essential components of effective diabetes education. Nurses commonly supplement verbal instruction with written materials, visual aids, structured handbooks, and practical exercises that reinforce key self-management skills. Such approaches are particularly valuable for teaching blood glucose monitoring, medication administration, and foot-care practices [37,46].

Equally important is the cultural adaptation of educational content. Effective diabetes education should account for dietary customs, family roles, local beliefs, socioeconomic constraints, and health literacy levels. Evidence from culturally tailored and family-supported DSMES programs indicates that adapting interventions to local contexts improves self-management practices and quality of life, particularly among underserved populations [18,54].

Accordingly, demonstrations, written materials, and cultural tailoring should be regarded as integral elements of educational design rather than supplementary teaching aids.

From a methodological standpoint, these components are often embedded within multicomponent interventions, making it difficult to isolate their specific effects on clinical outcomes; however, process evaluations consistently link them to improved comprehension, skill performance, and program acceptability. A more granular evaluation of these components, alongside overall clinical outcomes, remains an important research priority.

4.5 Technology-Based Support and Digital Reinforcement

Technology-assisted support has emerged as a major component of contemporary nurse-led DSMES. Mobile phones, telehealth platforms, text messaging, smartphone applications, remote monitoring systems, and hybrid digital programs enable nurses to extend support beyond face-to-face encounters while maintaining continuity of care [14,55].

Recent evidence supports the use of nurse-led digital interventions as effective adjuncts to conventional DSMES. Benefits have been reported across telehealth, SMS-based, app-supported, remote-monitoring, and nurse-coordinated care models, particularly when digital tools are integrated with individualized feedback and ongoing professional support [14,55].

Evidence suggests that technology is most effective when it enhances ongoing nursing support rather than replacing it. Digital interventions incorporating self-monitoring, medication

reminders, action planning, feedback, and professional coaching consistently outperform passive information-delivery systems [14,55–58].

Meta-analytic findings indicate that the average effects of digital DSMES on HbA1c are generally modest and heterogeneous, and that sustained patient engagement with apps and remote-monitoring platforms can be challenging[24,28,57].In addition, digital health tools may exacerbate inequities among individuals with limited access to reliable internet, low digital literacy, or limited device availability, underscoring the need to pair technology-based support with tailored training and alternative delivery modes for these populations.

The most effective nurse-led DSMES programs combine individualized assessment, structured teaching, counseling, practical skills training, and follow-up support delivered in culturally appropriate ways, including digital formats when access is available. These complementary strategies facilitate both knowledge acquisition and the long-term maintenance of self-management behaviors, thereby improving clinical and behavioral outcomes.

Table 1 summarizes the principal educational strategies employed by nurses in DSMES programs, their proposed mechanisms of action, implementation considerations, and supporting evidence.

5 Clinical and behavioral outcomes

The effectiveness of nurse-led diabetes self-management education and support (DSMES) is best understood across multiple outcome domains rather than solely through glycemic control. Contemporary evidence indicates that these interventions influence diabetes knowledge, self-efficacy, self-care behaviors, clinical indicators, and psychosocial well-being, reflecting the multidimensional nature of diabetes management[2,5].

5.1 Improvement in Diabetes Knowledge and Self-Efficacy

Knowledge acquisition and self-efficacy represent important proximal outcomes through which educational interventions influence long-term diabetes control. Nurse-led DSMES consistently improves patients' understanding of diabetes management and enhances their confidence in performing daily self-care activities.

Recent evidence demonstrates substantial improvements in self-efficacy following nurse-led interventions. A meta-analysis of randomized controlled trials reported a pooled self-efficacy effect size of SMD 1.48, while multicenter educational interventions and personalized nurse-led engagement programs similarly documented significant gains in self-efficacy, treatment engagement, and self-management confidence[12,37,39]. These findings support the view that nurse-led DSMES works not only by increasing knowledge but also by strengthening patients' confidence in their ability to apply that knowledge effectively in everyday situations.

These proximal changes are consistent with broader meta-analytic findings from theory-based self-management interventions, which report significant improvements in self-efficacy and diabetes-related knowledge when educational content is explicitly grounded in behavioral and social-cognitive theories, suggesting that nurse-led DSMES benefits from similar mechanisms [59].

However, most self-efficacy outcomes are self-reported and measured using heterogeneous instruments, and relatively few studies follow patients beyond 12 months, limiting conclusions about the durability of these proximal gains [26,60,61].

5.2 Improvement in Self-Care Behaviors

Evidence supporting improvements in self-care behaviors is particularly robust. Nurse-led interventions have demonstrated positive effects across multiple domains, including healthy eating, medication management, blood glucose monitoring, physical activity, and foot care.

In a multicenter randomized controlled trial, participants receiving nurse-led structured education demonstrated improvements in dietary behaviors, including increased fruit and vegetable consumption and reduced intake of high-fat foods, together with better glucose monitoring, medication management, and foot-care practices [37]. Similar improvements have been reported across culturally tailored DSMES programs, personalized engagement interventions, mobile-health approaches, and nurse-led digitalized care models[47,54,55]. A recent meta-analysis of nurse-led digital interventions reported a pooled improvement in self-care behaviors of SMD 1.15 [55].

These findings suggest that nurse-led DSMES can produce moderate-to-large improvements in self-reported frequency of self-care behaviors across multiple domains.Nevertheless, behavioral outcomes are predominantly assessed using self-report questionnaires with variable psychometric properties, and few studies incorporate objective indicators (e.g., device downloads, pharmacy refill data, accelerometry), which may increase the risk of social desirability and recall bias.Future trials incorporating standardized, validated self-care measures and objective behavioral indicators would allow more precise estimation of the behavioral impact of nurse-led DSMES.

5.3 Clinical Outcomes: Glycemic Control and Other Indicators

Clinical outcomes provide the most direct evidence of intervention effectiveness. Recent systematic reviews consistently demonstrate clinically meaningful improvements in glycemic control associated with participation in DSMES.

Early landmark meta-analyses of DSME [8,9] showed that structured DSME leads to average HbA1c reductions of approximately 0.5–0.8 percentage points compared with usual care, with larger effects observed when contact time exceeds about 10 hours and when education is combined with behavioral support components.

These foundational findings are corroborated by more recent syntheses that incorporate DSMES and complex behavioral programs. The strongest evidence comes from a network meta-analysis of 108 studies involving 17,735 participants, which reported an HbA1c reduction of −0.61% for DSMES compared with usual care and an additional −0.23% improvement compared with DSME alone[16].Within nurse-led interventions specifically, a meta-analysis of randomized controlled trials demonstrated HbA1c reductions of −0.92% at 4–6 months and −0.54% beyond six months, together with improvements in fasting blood glucose and lipid profiles[12]. Additional evidence from digitalized nurse-led programs reported a pooled HbA1c reduction of −0.25%, while multicenter nurse-led trials documented significant improvements in HbA1c and multiple self-management outcomes [37,55].

A behavioral program network meta-analysis further indicates that DSME/DSMES interventions offering ≥11 contact hours and integrating lifestyle or psychosocial support are more likely to achieve clinically important HbA1c reductions (≥0.4%) than brief, education-only programs with ≤10 contact hours[10].

Despite these favorable findings, substantial heterogeneity exists across intervention intensity, duration, delivery methods, and patient populations. Recent umbrella reviews therefore

emphasize that while DSMES consistently improves glycemic outcomes, intervention effectiveness varies considerably across settings and implementation models[12,34].

Heterogeneity reflects differences in baseline HbA1c, patient characteristics (e.g., age, comorbidities, socioeconomic status), theoretical underpinnings, and program fidelity, and many trials are at moderate or high risk of bias due to unclear allocation concealment, limited blinding, and incomplete follow-up [9]. In addition, effect sizes tend to attenuate over time once intensive contact ceases, suggesting that maintenance strategies and ongoing support are essential if glycemic improvements are to be sustained beyond the first 6–12 months [8].

Other cardiometabolic indicators, including blood pressure and lipid profiles, show generally favorable but smaller and less consistently reported improvements, and data on hard outcomes (microvascular and macrovascular events) remain limited.

5.4 Psychological and Quality-of-Life Outcomes

Psychological outcomes are increasingly recognized as a benefit of nurse-led diabetes care. Beyond improving glycemic indicators, nursing interventions frequently reduce diabetes-related distress, strengthen coping skills, and improve quality of life.

Randomized studies of nurse-led motivational interviewing have also reported improvements in self-management confidence and selected metabolic indicators, suggesting that behavioral counseling may contribute to both psychological and clinical benefits [43].

A recent systematic review and meta-analysis reported a significant reduction in diabetes distress (SMD −0.36) following nurse-led psychological interventions, although effects on depression were less consistent[62]. Similarly, community-based, culturally tailored DSMES programs and digitally enabled nurse-led interventions have demonstrated meaningful improvements in quality of life and psychosocial well-being[54,55].

These contemporary findings align with earlier meta-analyses of diabetes self-management training, which documented small-to-moderate improvements in quality-of-life measures, despite substantial variability in instruments and reporting practices [63]. However, psychological and quality-of-life outcomes remain under-reported relative to glycemic endpoints, and follow-up periods are often short, making it difficult to determine the long-term impact of nurse-led DSMES on emotional well-being and treatment satisfaction.

More consistent inclusion of validated measures of distress, depression, and quality of life, together with longer follow-up, would substantially strengthen the evidence base in this domain.

These findings suggest that nurse-led DSMES addresses both the behavioral and emotional challenges associated with long-term diabetes management.

By targeting self-efficacy, coping skills, and diabetes-related distress, nurse-led interventions may enhance patients' capacity to sustain self-management behaviors, thereby indirectly supporting glycemic and cardiometabolic outcomes.

5.5 Real-World Effectiveness of DSMES

Evidence from routine clinical practice further supports the effectiveness of DSMES. In a retrospective cohort study involving 13,087 patients, participation in DSMES was associated with an adjusted HbA1c reduction of 1.03% over 24 months, representing a 0.19% greater decline than that observed among non-participants [42]. This real-world evidence strengthens the argument that the benefits of DSMES are not confined to controlled research settings but can also be achieved in routine clinical care when educational and supportive interventions are systematically implemented.

Additional pragmatic and implementation studies in primary care and community settings similarly report feasible integration of DSMES into clinical workflows, modest but meaningful

improvements in glycemic control, and increased uptake when referral systems and practice-level supports are optimized [32,35,36]. ***Table 2*** summarizes key contemporary evidence regarding the clinical, behavioral, and psychosocial outcomes associated with nurse-led DSMES interventions.

Overall, the evidence indicates that nurse-led DSMES produces meaningful improvements in diabetes knowledge, self-efficacy, self-care behaviors, glycemic control, and psychosocial well-being. Although effect sizes vary across intervention types and populations, the consistency of findings across randomized trials, systematic reviews, and real-world studies supports integrating nurse-led DSMES as a core component of comprehensive diabetes care.

At the same time, substantial heterogeneity, risk of bias, reliance on self-reported outcomes, and limited long-term data highlight the need for further high-quality, theory-informed, nurse-led DSMES trials and pragmatic implementation studies that incorporate longer follow-up and more robust clinical and psychosocial endpoints.

6 Barriers to effective nursing support

Despite the growing evidence supporting nurse-led diabetes self-management education and support (DSMES), multiple patient-, provider-, and system-level barriers continue to limit its effectiveness and scalability. Understanding these challenges is essential for translating research findings into sustainable clinical practice.

6.1 Health-System and Workforce Barriers

One of the most frequently reported barriers is insufficient time and workforce capacity. Diabetes self-management support requires repeated assessment, individualized coaching, behavioral reinforcement, and follow-up; however, these activities are often constrained by

staffing shortages, increasing patient volumes, and competing clinical priorities. In many healthcare settings, educational encounters remain brief and episodic, limiting opportunities for reinforcement, reassessment, and collaborative problem-solving[18,64].

Fragmented continuity of care further weakens the effectiveness of interventions. Patients may receive education during hospitalization or clinic visits, but experience little structured follow-up thereafter. Such discontinuity reduces opportunities to identify emerging self-management difficulties and may contribute to declining adherence over time. Current DSMES standards emphasize longitudinal engagement, yet implementation remains inconsistent across healthcare systems [18,64].

6.2 Health Literacy and Numeracy Challenges

Health literacy represents another major determinant of successful diabetes self-management. Many patients struggle to interpret blood glucose readings, understand medication schedules, recognize symptoms requiring intervention, or apply dietary recommendations in everyday situations. Limited numeracy may further impair the ability to adjust insulin doses, interpret nutrition labels, or understand trends in glucose monitoring data[65,66].

Educational attainment alone does not guarantee adequate health literacy. Patients may demonstrate good factual knowledge while still experiencing difficulty applying this knowledge to complex self-management decisions. Consequently, literacy-sensitive communication, teach-back methods, visual learning tools, and simplified educational materials should be considered essential components of nursing practice rather than optional enhancements.

6.3 Socioeconomic Determinants of Self-Management

Socioeconomic barriers frequently undermine self-management despite adequate educational support. Financial constraints, transportation difficulties, food insecurity, unstable employment,

medication costs, and limited access to monitoring supplies can substantially restrict patients' ability to implement recommended behaviors[64,67].

These challenges highlight an important distinction between knowledge deficits and resource deficits. Patients may fully understand recommended self-care practices but remain unable to perform them because of structural barriers. Consequently, effective nursing support increasingly requires attention to social determinants of health, referral to community resources, and adaptation of care plans to patients' economic realities.

6.4 Cultural, Linguistic, and Contextual Barriers

Cultural and linguistic mismatches can reduce engagement with DSMES programs and limit the uptake of self-management recommendations. Educational approaches that fail to account for cultural food practices, family structures, health beliefs, language preferences, and community norms may be less effective, even when clinically accurate.

Recent evidence indicates that participation in culturally tailored DSMES programs is influenced by multiple factors, including cultural beliefs, emotional support, language accessibility, perceived program relevance, and trust in healthcare providers[68]. These findings underscore the importance of culturally responsive nursing practice and suggest that intervention effectiveness depends not only on educational content but also on contextual relevance.

6.5 Digital Divide and Technology-Related Challenges

Digital health technologies offer opportunities to expand nursing reach; however, they do not eliminate existing barriers. Technology-based interventions may be less effective among individuals with limited digital literacy, inadequate internet connectivity, low confidence in technology use, or restricted access to smartphones and digital devices[24,69].

Furthermore, digital platforms cannot fully replace the relational aspects of nursing support. Evidence increasingly suggests that technology is most effective when integrated with personalized feedback, coaching, and professional follow-up rather than functioning as a stand-alone educational tool [24,69].

6.6 Implementation and Sustainability Challenges

Implementation challenges extend beyond individual patients and providers to the organization of diabetes services themselves. In many healthcare systems, DSMES remains inconsistently integrated into routine care pathways, resulting in variable referral practices, incomplete documentation, limited outcome monitoring, and inconsistent follow-up. As a result, many eligible patients never receive structured self-management support despite strong evidence of its benefits. The challenge is therefore not only to generate evidence for DSMES effectiveness but also to embed evidence-based programs into routine clinical workflows. Future implementation efforts should focus on improving referral systems, increasing program accessibility, strengthening workforce capacity, and developing sustainable models adaptable across primary care, community, and technology-enabled settings [18].

A further challenge concerns the sustainability of interventions. While short- and medium-term benefits are well established, uncertainty remains regarding the optimal intensity, duration, and combination of educational and supportive components needed to maintain behavioral change over many years. Differences in age, comorbidity burden, socioeconomic circumstances, and healthcare infrastructure may influence intervention effectiveness, suggesting that flexible and context-specific implementation strategies will be necessary for long-term success [34,70].

7 Implications for Practice

The current evidence suggests that the future role of nurses in diabetes care extends beyond patient education toward coordination of long-term self-management support. As diabetes management becomes increasingly complex, nurses are uniquely positioned to integrate clinical care, behavioral counseling, psychosocial assessment, and community resource navigation within a single patient-centered framework. Consequently, healthcare systems should recognize DSMES as a core chronic disease management service rather than an optional educational intervention [18,34]. This implies that nurse-led DSMES should be embedded in routine care pathways, supported by dedicated time, training, and reimbursement mechanisms, rather than delivered on an ad hoc or "as-available" basis.

A second implication concerns service design. Effective diabetes support requires continuity rather than isolated encounters. Clinical pathways should therefore facilitate ongoing reassessment of patient needs, adaptation of self-management goals, and timely intervention when barriers emerge. Such an approach aligns more closely with the chronic and dynamic nature of diabetes than traditional episodic education models [55,71].

Practical strategies include scheduled DSMES review points aligned with guideline-recommended "critical times," use of nurse-led follow-up calls or digital contacts between clinic visits, and clear criteria for re-referral to more intensive support when treatment targets are not met.

The findings also highlight the importance of equity-oriented care. Nurses increasingly encounter populations affected by limited health literacy, socioeconomic disadvantage, cultural barriers, and restricted access to healthcare resources. Future DSMES programs should therefore incorporate culturally responsive communication, literacy-sensitive educational materials, and strategies that address social determinants of health alongside clinical management [68,72].

This may involve integrating structured health literacy and social needs assessments into nursing practice, building partnerships with community organizations, and tailoring DSMES content and delivery modes to the needs of specific populations (e.g., rural residents, migrants, young adults). Family and social support networks should also be considered within routine diabetes care. Sustained self-management often depends on factors beyond the individual patient, including household routines, caregiving responsibilities, transportation, and emotional support. Incorporating family members or care supporters, where appropriate, may strengthen adherence and facilitate the maintenance of behavioral changes over time [73,74].

Interdisciplinary collaboration remains essential, but nurses should continue to serve as key coordinators within diabetes care pathways. Their position at the interface of clinical management, patient education, psychosocial support, and community engagement enables them to facilitate communication across disciplines and promote continuity of care [18,75].

Finally, outcome evaluation should reflect the multidimensional objectives of DSMES. Although HbA1c remains an important indicator, successful self-management support should also be assessed through measures of self-efficacy, self-care performance, treatment engagement, diabetes distress, quality of life, and program participation. Broader evaluation frameworks may provide a more accurate representation of nursing contributions to diabetes outcomes and facilitate continuous improvement of DSMES services [54,62].

8 Conclusion

The shift in diabetes care from education-focused approaches to comprehensive self-management support has underscored the central role of nursing in chronic disease management. The literature reviewed in this article shows that nurses contribute not only to knowledge transfer

but also to the ongoing processes through which patients interpret information, adapt behaviors, address barriers, and maintain self-care over time. Nurse-led DSMES is effective because it links clinical recommendations to the practical decisions patients make every day. Through individualized assessment, behavioral coaching, psychosocial support, and continuous follow-up, nurses help make self-management more feasible in routine life. This role is especially important in contemporary healthcare settings marked by increasing treatment complexity, a growing diabetes burden, and persistent inequities in access to care. Despite these advances, important challenges remain in implementation, sustainability, and equitable reach. Future research should focus on identifying the most effective implementation models, clarifying the mechanisms that support long-term behavior change, and improving access for underserved populations. Addressing these priorities will be essential to maximizing the contribution of nurse-led DSMES to population-level diabetes outcomes.

Abbreviation List

Abbreviation	Definition
ADA	American Diabetes Association
ADCES	Association of Diabetes Care & Education Specialists
CGM	Continuous Glucose Monitoring
DSME	Diabetes Self-Management Education
DSMES	Diabetes Self-Management Education and Support
FBG	Fasting Blood Glucose
HbA1c	Glycated Hemoglobin
LMICs	Low- and Middle-Income Countries
QoL	Quality of Life
RCT	Randomized Controlled Trial
SDM	Shared Decision-Making
SMD	Standardized Mean Difference
SMBG	Self-Monitoring of Blood Glucose
T2DM	Type 2 Diabetes Mellitus
WHO	World Health Organization

REFERENCES

1. Zhou B, Rayner AW, Gregg EW, Sheffer KE, Carrillo-Larco RM, Bennett JE, et al. Worldwide trends in diabetes prevalence and treatment from 1990 to 2022: a pooled analysis of 1108 population-representative studies with 141 million participants. The Lancet. 2024 Nov;404(10467):2077–93. doi:10.1016/S0140-6736(24)02317-1

2. American Diabetes Association Professional Practice Committee for Diabetes*, Bajaj M, McCoy RG, Balapattabi K, Bannuru RR, Bellini NJ, et al. 5. Facilitating Positive Health Behaviors and Well-being to Improve Health Outcomes: Standards of Care in Diabetes—2026. Diabetes Care. 2026 Jan 1;49(Supplement_1):S89–131. doi:10.2337/dc26-S005

3. Stafford LK, Gage A, Xu YY, Conrad M, Beltran IB, Boyko EJ, et al. Global, regional, and national cascades of diabetes care, 2000–23: a systematic review and modelling analysis using findings from the Global Burden of Disease Study. Lancet Diabetes Endocrinol. 2025 Nov 1;13(11):924–34. doi:10.1016/S2213-8587(25)00217-7

4. Tharakan A, McPeek Hinz E, Zhu E, Denmeade B, German J, Huang WA, et al. Accessibility of diabetes education in the United States: barriers, policy implications, and the road ahead. Health Aff Sch. 2024 Aug 2;2(8):qxae097. doi:10.1093/haschl/qxae097

5. Powers MA, Bardsley JK, Cypress M, Funnell MM, Harms D, Hess-Fischl A, et al. Diabetes Self-management Education and Support in Adults with Type 2 Diabetes: A Consensus Report of the American Diabetes Association, the Association of Diabetes Care & Education Specialists, the Academy of Nutrition and Dietetics, the American Academy. Diabetes Care. 2020. doi:10.2337/dci20-0023

6. Diabetes Canada Clinical Practice Guidelines Expert Committee, Sherifali D, Berard LD, Gucciardi E, MacDonald B, MacNeill G. Self-Management Education and Support. Can J Diabetes. 2018 Apr;42 Suppl 1:S36–41. doi:10.1016/j.jcjd.2017.10.006 PubMed PMID: 29650109.

7. Asmat K, Sivarajan Froelicher E, Dhamani KA, Gul R, Khan N. Effect of patient-centered self-management intervention on glycemic control, self-efficacy, and self-care behaviors in South Asian adults with type 2 diabetes mellitus: A multicenter randomized controlled trial. J Diabetes. 2024 Sep;16(9):e13611. doi:10.1111/1753-0407.13611

8. Norris SL, Lau J, Smith SJ, Schmid CH, Engelgau MM. Self-management education for adults with type 2 diabetes: a meta-analysis of the effect on glycemic control. Diabetes Care. 2002 Jul;25(7):1159–71. doi:10.2337/diacare.25.7.1159 PubMed PMID: 12087014.

9. Chrvala CA, Sherr D, Lipman RD. Diabetes self-management education for adults with type 2 diabetes mellitus: A systematic review of the effect on glycemic control. Patient Educ Couns. 2016 Jun;99(6):926–43. doi:10.1016/j.pec.2015.11.003

10. Pillay J, Armstrong MJ, Butalia S, Donovan LE, Sigal RJ, Vandermeer B, et al. Behavioral Programs for Type 2 Diabetes Mellitus. Ann Intern Med. 2015 Dec;163(11):848–60. doi:10.7326/M15-1400

11. Highton PJ, Funnell MP, Gupta P, Zaccardi F, Lim LL, Seidu S, et al. Improving medication adherence in type 2 diabetes: strategies for better clinical and economic outcomes. Diabetologia. 2026 Mar;69(3):541–56. doi:10.1007/s00125-025-06617-x

12. Sun J, Fan Z, Kou M, Wang X, Yue Z, Zhang M. Impact of nurse-led self-management education on type 2 diabetes: a meta-analysis. Front Public Health. 2025 Aug 11;13:1622988. doi:10.3389/fpubh.2025.1622988

13. Underwood PC, Ruscitti B, Nguyen T, Magny-Normilus C, Wentzell K, Watts SA, et al. A Health Systems Approach to Nurse-Led Implementation of Diabetes Prevention and Management in Vulnerable Populations. Health Syst Reform. 2025 Dec 31;11(1):2503648. doi:10.1080/23288604.2025.2503648

14. Alhaiti A. Integrative technologies in nursing-led interventions for diabetes management: a systematic review of efficacy and outcomes. BMC Nurs. 2025 Jul 4;24(1):846. doi:10.1186/s12912-025-03435-9

15. Rodríguez-García A, Borrallo-Riego Á, Magni E, Guerra-Martín MD. Effectiveness of Advanced Practice Nursing Interventions on Diabetic Patients: A Systematic Review. Healthcare. 2025 Mar 26;13(7):738. doi:10.3390/healthcare13070738

16. Romadlon DS, Tu YK, Chen YC, Hasan F, Kurniawan R, Chiu HY. Comparative Effects of Diabetes Self-Management Programs on Type 2 Diabetes Clinical Outcomes: A Systematic Review and Network Meta-Analysis. Diabetes Metab Res Rev. 2024 Sep;40(6):e3840. doi:10.1002/dmrr.3840 PubMed PMID: 39267360.

17. Norris SL, Engelgau MM, Narayan KM. Effectiveness of self-management training in type 2 diabetes: a systematic review of randomized controlled trials. Diabetes Care. 2001 Mar;24(3):561–87. doi:10.2337/diacare.24.3.561 PubMed PMID: 11289485.

18. Davis J, Fischl AH, Beck J, Browning L, Carter A, Condon JE, et al. 2022 National Standards for Diabetes Self-Management Education and Support. Diabetes Care. 2022 Feb 1;45(2):484–94. doi:10.2337/dc21-2396

19. Fisher EB, Brownson CA, O'Toole ML, Shetty G, Anwuri VV, Glasgow RE. Ecological Approaches to Self-Management: The Case of Diabetes. Am J Public Health. 2005 Sep;95(9):1523–35. doi:10.2105/AJPH.2005.066084

20. Tamiru S, Dugassa M, Amsalu B, Bidira K, Bacha L, Tsegaye D. Effects of Nurse-Led diabetes Self-Management education on Self-Care knowledge and Self-Care behavior among adult patients with type 2 diabetes mellitus attending diabetes follow up clinic: A Quasi-Experimental study design. Int J Afr Nurs Sci. 2023 Jan 1;18:100548. doi:10.1016/j.ijans.2023.100548

21. Ortíz GO, Vega García S, Islas Salinas C, Muñoz Torres AV, Velázquez López L. Usability evaluation of the educational website "understanding my diabetes" for Mexican patients with type 2 diabetes. Front Public Health. 2024 May 10;12:1394066. doi:10.3389/fpubh.2024.1394066

22. Coningsby I, Ainsworth B, Dack C. A qualitative study exploring the barriers to attending structured education programmes among adults with type 2 diabetes. BMC Health Serv Res. 2022 Apr 30;22(1):584. doi:10.1186/s12913-022-07980-w

23. Olorunfemi O, Oni OF, Owoyomi DO. Transforming Diabetes Care through Self-care: The Role of Customized Nutrition Plans and Carbohydrate Tracking in Achieving Weight Regulation and Improved Clinical Outcomes. Bangladesh J Endocrinol Metab. 2025 Apr;4(1):26. doi:10.4103/bjem.bjem_28_24

24. Kerr D, Ahn D, Waki K, Wang J, Breznen B, Klonoff DC. Digital Interventions for Self-Management of Type 2 Diabetes Mellitus: Systematic Literature Review and Meta-Analysis. J Med Internet Res. 2024 Jul 22;26:e55757. doi:10.2196/55757

25. Chowdhury HA, Harrison CL, Siddiquea BN, Tissera S, Afroz A, Ali L, et al. The effectiveness of diabetes self-management education intervention on glycaemic control and cardiometabolic risk in adults with type 2 diabetes in low- and middle-income countries: A systematic review and meta-analysis. Werfalli MM, editor. PLOS ONE. 2024 Feb 2;19(2):e0297328. doi:10.1371/journal.pone.0297328

26. Zhao FF, Suhonen R, Koskinen S, Leino-Kilpi H. Theory-based self-management educational interventions on patients with type 2 diabetes: a systematic review and meta-analysis of randomized controlled trials. J Adv Nurs. 2017;73(4):812–33. doi:10.1111/jan.13163

27. Tanaka R, Shibayama T, Sugimoto K, Hidaka K. Diabetes self-management education and support for adults with newly diagnosed type 2 diabetes mellitus: A systematic review and meta-analysis of randomized controlled trials. Diabetes Res Clin Pract. 2020 Nov;169:108480. doi:10.1016/j.diabres.2020.108480 PubMed PMID: 33002545.

28. Versluis A, Boels AM, Huijden MCG, Mijnsbergen MD, Rutten GEHM, Vos RC. Diabetes self-management education and support delivered by mobile health (mHealth) interventions for adults with type 2 diabetes—A systematic review and meta-analysis. Diabet Med. 2025 May;42(5):e70002. doi:10.1111/dme.70002

29. Baridah HA, Sudiana IK, Supriyanto S. Effectiveness Diabetes Self Care Management Education (DSME) intervention with Short Message Service (SMS) or Mobile Application in Glycemic Control: A Systematic Review. Indones Nurs J Educ Clin INJEC. 2020 Sep 23;6(1):99. doi:10.24990/injec.v6i1.340

30. Dailah HG. The Influence of Nurse-Led Interventions on Diseases Management in Patients with Diabetes Mellitus: A Narrative Review. Healthcare. 2024 Jan 30;12(3):352. doi:10.3390/healthcare12030352 PubMed PMID: 38338237; PubMed Central PMCID: PMC10855413.

31. Adamu NL, Merzah M, Iminza D, Tano KF, Abaate TJ, Thapa P. Effectiveness of Diabetes Self-Management Education and Support on Glycemic Control and Diabetes-Related Outcomes in Africa: A Systematic Review and Meta-Analysis. AJPM Focus. 2025 Aug 20;100416. doi:10.1016/j.focus.2025.100416

32. Ory MGG, Han G, Nsobundu C, Carpenter K, Towne SD, Smith ML. Comparative effectiveness of diabetes self-management education and support intervention strategies among adults with type 2 diabetes in Texas. Front Public Health. 2025 Mar 18;13. doi:10.3389/fpubh.2025.1543298

33. Yimer YS, Addissie A, Kidane EG, Reja A, Abdela AA, Ahmed AA. Effectiveness of diabetes self-management education and support interventions on glycemic levels among people living with type 2 diabetes in the WHO African Region: a Systematic Review and meta-analysis. Front Clin Diabetes Healthc. 2025 Jun 3;6:1554524. doi:10.3389/fcdhc.2025.1554524

34. Ma L, Zhao WS, Wang R, Huo SS, Chu SY, Shi LH, et al. Effect of diabetes self-management education in type 2 diabetes management - a systematic umbrella review of meta-analysis. BMC Endocr Disord. 2026 Feb 5;26(1):79. doi:10.1186/s12902-026-02183-4

35. Lacy ME, Elliott J, Drakeford V, Wright L, McKune B, Douthitt KC, et al. Increasing Uptake of Diabetes Self-Management Education and Support (DSMES) in Rural Kentucky Primary Care Clinics: Findings From a Pilot Pragmatic Cluster-Randomized Trial. J Prim Care Community Health. 2026 Jun 1;17:21501319261428883. doi:10.1177/21501319261428883

36. Changsieng P, Pichayapinyo P, Lagampan S, Lapvongwatana P. Implementation of Self-Care Deficits Assessment and a Nurse-Led Supportive Education Program in Community Hospitals for Behavior Change and HbA1c Reduction: A Cluster Randomized Controlled Trial. J Prim Care Community Health. 2023 Jan;14:21501319231181106. doi:10.1177/21501319231181106

37. Yu X, Chau JPC, Huo L, Li X, Wang D, Wu H, et al. The effects of a nurse-led integrative medicine-based structured education program on self-management behaviors among individuals with newly diagnosed type 2 diabetes: a randomized controlled trial. BMC Nurs. 2022 Aug 5;21(1):217. doi:10.1186/s12912-022-00970-7

38. Wang M, Lee K, Thew HZ, Sowtali SN, Jiang Q, Cao Y, et al. Medication Adherence Interventions Among People Living with Diabetes: A Systematic Review. Patient Prefer Adherence. 2025 Oct;Volume 19:3095–112. doi:10.2147/PPA.S544443

39. Cengiz D, Korkmaz F. Effectiveness of a nurse-led personalized patient engagement program to promote type 2 diabetes self-management: A randomized controlled trial. Nurs Health Sci. 2023 Dec;25(4):571–84. doi:10.1111/nhs.13048

40. Sapkota S, Brien J anne E, Greenfield JR, Aslani P. A Systematic Review of Interventions Addressing Adherence to Anti-Diabetic Medications in Patients with Type 2 Diabetes—Components of Interventions. PLoS ONE. 2015 Jun 8;10(6):e0128581. doi:10.1371/journal.pone.0128581 PubMed PMID: 26053004; PubMed Central PMCID: PMC4460122.

41. American Diabetes Association Professional Practice Committee for Diabetes. 7. Diabetes Technology: Standards of Care in Diabetes—2026. Diabetes Care. 2025 Dec 8;49(Supplement_1):S150–65. doi:10.2337/dc26-S007

42. Lalani B, Maruthur NM, Arnold E, Berkowitz SA, Fu J, Han D, et al. Effect of diabetes self-management education and support on long-term glycemic control. Diabetes Epidemiol Manag. 2026 Jan 1;21:100312. doi:10.1016/j.deman.2026.100312

43. İşleyen EK, Özdemir İN, Yoldemır ŞA. The effect of tele-nursing based motivational interviewing on self-efficacy, self-management and metabolic control parameters in individuals with type 2 diabetes: randomized controlled study. Ir J Med Sci 1971 -. 2025 Apr;194(2):563–73. doi:10.1007/s11845-025-03916-5

44. Wang L, Li J, Zhang M, Chan MMK, Ho M. Effectiveness of Transtheoretical Model-Based Motivational Interviewing on Glycemic Control Among Adults With Type 2 Diabetes: A Systematic Review and Meta-Analysis of Randomized Control Trials. Worldviews Evid Based Nurs. 2025 Jun;22(3):e70041. doi:10.1111/wvn.70041

45. American Diabetes Association Professional Practice Committee for Diabetes*, Bajaj M, McCoy RG, Balapattabi K, Bannuru RR, Bellini NJ, et al. 12. Retinopathy, Neuropathy, and Foot Care: Standards of Care in Diabetes—2026. Diabetes Care. 2026 Jan 1;49(Supplement_1):S261–76. doi:10.2337/dc26-S012

46. Çelik Polat E, Arıkan Dönmez A, Çakal E. A nurse-led self-efficacy–based hybrid diabetic foot self-management education program for individuals with diabetes: a randomized controlled trial. BMC Nurs. 2026 Feb 10;25(1):233. doi:10.1186/s12912-026-04396-3

47. Asante E, Carter G, McAneney H, Bam V, Sarfo-Kantanka O, Prue G. Nurse-Led Mobile Phone Intervention to Promote Self-Management in Type 2 Diabetes in Ghana: A Randomized Controlled Trial. Sci Diabetes Self-Manag Care. 2025 Feb;51(1):85–99. doi:10.1177/26350106241293113

48. Steinsbekk A, Rygg L, Lisulo M, Rise MB, Fretheim A. Group based diabetes self-management education compared to routine treatment for people with type 2 diabetes mellitus. A systematic review with meta-analysis. BMC Health Serv Res. 2012 Jul 23;12:213. doi:10.1186/1472-6963-12-213 PubMed PMID: 22824531; PubMed Central PMCID: PMC3418213.

49. Odgers-Jewell K, Ball LE, Kelly JT, Michaleff ZA, Clark J, Jones MA, et al. Group-based self-management education for people with type 2 diabetes mellitus. Cochrane Database Syst Rev. 2023 Sep 12;2023(9):CD014742. doi:10.1002/14651858.CD014742 PubMed PMID: null; PubMed Central PMCID: PMC10496127.

50. Azmiardi A, Murti B, Febrinasari RP, Tamtomo DG. The effect of peer support in diabetes self-management education on glycemic control in patients with type 2 diabetes: a systematic review and meta-analysis. Epidemiol Health. 2021 Oct 22;43:e2021090. doi:10.4178/epih.e2021090

51. Impact of Motivational Interviewing on Self-Management in Patients With Type 2 Diabetes: Protocol for a Pilot Randomized Controlled Trial. JMIR Res Protoc. 2020 Mar 1;9(3). doi:10.2196/15709

52. Concert CM, Burke RE, Eusebio AM, Slavin EA, Shortridge-Baggett LM. The Effectiveness of Motivational Interviewing on Glycemic Control for Adults with Type 2 Diabetes Mellitus (DM2): A Systematic Review. JBI Libr Syst Rev. 2012;10(42 Suppl):1–17. doi:10.11124/jbisrir-2012-246 PubMed PMID: 27820150.

53. Ekong G, Kavookjian J. Motivational interviewing and outcomes in adults with type 2 diabetes: A systematic review. Patient Educ Couns. 2016 Jun 1;99(6):944–52. doi:10.1016/j.pec.2015.11.022

54. Diriba DC, Leung DYP, Suen LKP. Nurse-led self-management education and support programme on self-management behaviour and quality of life among adults with type 2 diabetes: A pilot randomized controlled trial. Int J Nurs Pract. 2024 Apr;30(2):e13245. doi:10.1111/ijn.13245

55. Makhfudli M, Efendi F, Pradipta RO, Ismanto AY, Chong M, Tonapa SI. Efficacy of Nurse-Led Digitalized Diabetes Management Program for Community-Dwelling Patients With Type 2 Diabetes Mellitus: A Systematic Review and Meta-Analysis. J Nurs Scholarsh. 2025 Sep;57(5):713–27. doi:10.1111/jnu.70022

56. Dailah HG, Koriri M, Sabei A, Kriry T, Zakri M. Artificial Intelligence in Nursing: Technological Benefits to Nurse's Mental Health and Patient Care Quality. Healthcare. 2024 Dec 18;12(24):2555. doi:10.3390/healthcare12242555 PubMed PMID: 39765983; PubMed Central PMCID: PMC11675209.

57. Lu T, Lin Q, Yu B, Hu J. A systematic review of strategies in digital technologies for motivating adherence to chronic illness self-care. Npj Health Syst. 2025 Apr 26;2(1):13. doi:10.1038/s44401-025-00017-4

58. Moon Z, Walsh J. Digital interventions in medication adherence: a narrative review of current evidence and challenges. Front Pharmacol. 2025 Oct 10;16:1632474. doi:10.3389/fphar.2025.1632474 PubMed PMID: 41142237; PubMed Central PMCID: PMC12549263.

59. Mohamed A, Staite E, Ismail K, Winkley K. A systematic review of diabetes self-management education interventions for people with type 2 diabetes mellitus in the Asian Western Pacific (AWP) region. Nurs Open. 2019 Sep 3;6(4):1424–37. doi:10.1002/nop2.340 PubMed PMID: 31660170; PubMed Central PMCID: PMC6805261.

60. Jiang X, Jiang H, Li M. The Role of Self-Efficacy Enhancement in Improving Self-Management Behavior for Type 2 Diabetes Mellitus Patients. Diabetes Metab Syndr Obes. 2024 Aug 23;17:3131–8. doi:10.2147/DMSO.S460864 PubMed PMID: 39193548; PubMed Central PMCID: PMC11348925.

61. Qin W, Blanchette JE, Yoon M. Self-Efficacy and Diabetes Self-Management in Middle-Aged and Older Adults in the United States: A Systematic Review. Diabetes Spectr. 2020 Nov 1;33(4):315–23. doi:10.2337/ds19-0051

62. Hu H, Kuang L, Dai H, Sheng Y. Effectiveness of Nurse-Led Psychological Interventions on Diabetes Distress, Depression, and Glycemic Control in Individuals With Type 2 Diabetes Mellitus: A Systematic Review and Meta-Analysis. J Psychosoc Nurs Ment Health Serv. 2025 Mar;63(3):11–8. doi:10.3928/02793695-20241029-01

63. Cochran J, Conn VS. META-ANALYSIS OF QUALITY OF LIFE OUTCOMES FOLLOWING DIABETES SELF-MANAGEMENT TRAINING. Diabetes Educ. 2008;34(5):815. doi:10.1177/0145721708323640 PubMed PMID: 18832286; PubMed Central PMCID: PMC2822439.

64. Woodward A, Walters K, Davies N, Nimmons D, Protheroe J, Chew-Graham CA, et al. Barriers and facilitators of self-management of diabetes amongst people experiencing socioeconomic deprivation: A systematic review and qualitative synthesis. Health Expect. 2024 Jun;27(3):e14070. doi:10.1111/hex.14070

65. De Carvalho AC, Silva MT, Treptow ILG, Latorraca CDOC, Pacheco RL, Dos Santos Valsecchi VA, et al. Health literacy in patients with Type 2 Diabetes Mellitus: A systematic review. Clinics. 2025 Jan;80:100774. doi:10.1016/j.clinsp.2025.100774

66. Butayeva J, Ratan ZA, Downie S, Hosseinzadeh H. The impact of health literacy interventions on glycemic control and self-management outcomes among type 2 diabetes mellitus: A systematic review. J Diabetes. 2023 Sep;15(9):724–35. doi:10.1111/1753-0407.13436

67. Al-Salmi N, Muliira J, Lazarus ER. Medication Adherence in Adults with Type 2 Diabetes: A Comprehensive Qualitative Meta-Synthesis of Factors in the MENA Region. Patient Prefer Adherence. 2025 Jul;Volume 19:2263–81. doi:10.2147/PPA.S526844

68. Abu S, Llahana S. Factors influencing the uptake of culturally tailored diabetes self-management education and support programmes among ethnic minority patients with type 2 diabetes: A systematic review. Prim Care Diabetes. 2025 Apr;19(2):103–10. doi:10.1016/j.pcd.2025.01.010

69. Xiao Y, Wang Z, Zhang L, Xie N, Chen F, Song Z, et al. Effectiveness of Digital Diabetes Management Technology on Blood Glucose in Patients With Type 2 Diabetes at Home: Systematic Review and Meta-Analysis. J Med Internet Res. 2025 Mar 3;27:e66441. doi:10.2196/66441

70. Khavere S, Hadjiconstantinou M, Miksza J, Hagan J, Salisu-Olatunji S, Naderpour S, et al. Effectiveness of self-management interventions on Type 2 diabetes among young adults (18–45 years): A systematic review and meta-analysis. Diabet Med. 2025 Oct;42(10):e70127. doi:10.1111/dme.70127

71. Chen Y, Zhou T, Su L, Guo Y, Ke X. Effects of nurse-led telephone interventions on HbA1c levels in patients with type 2 diabetes: a Meta-analysis-based evaluation of follow-up protocols. BMC Nurs. 2025 Mar 13;24(1):284. doi:10.1186/s12912-025-02782-x

72. Asmat K, Dhamani K, Gul R, Froelicher ES. The effectiveness of patient-centered care vs. usual care in type 2 diabetes self-management: A systematic review and meta-analysis. Front Public Health. 2022 Oct 28;10:994766. doi:10.3389/fpubh.2022.994766

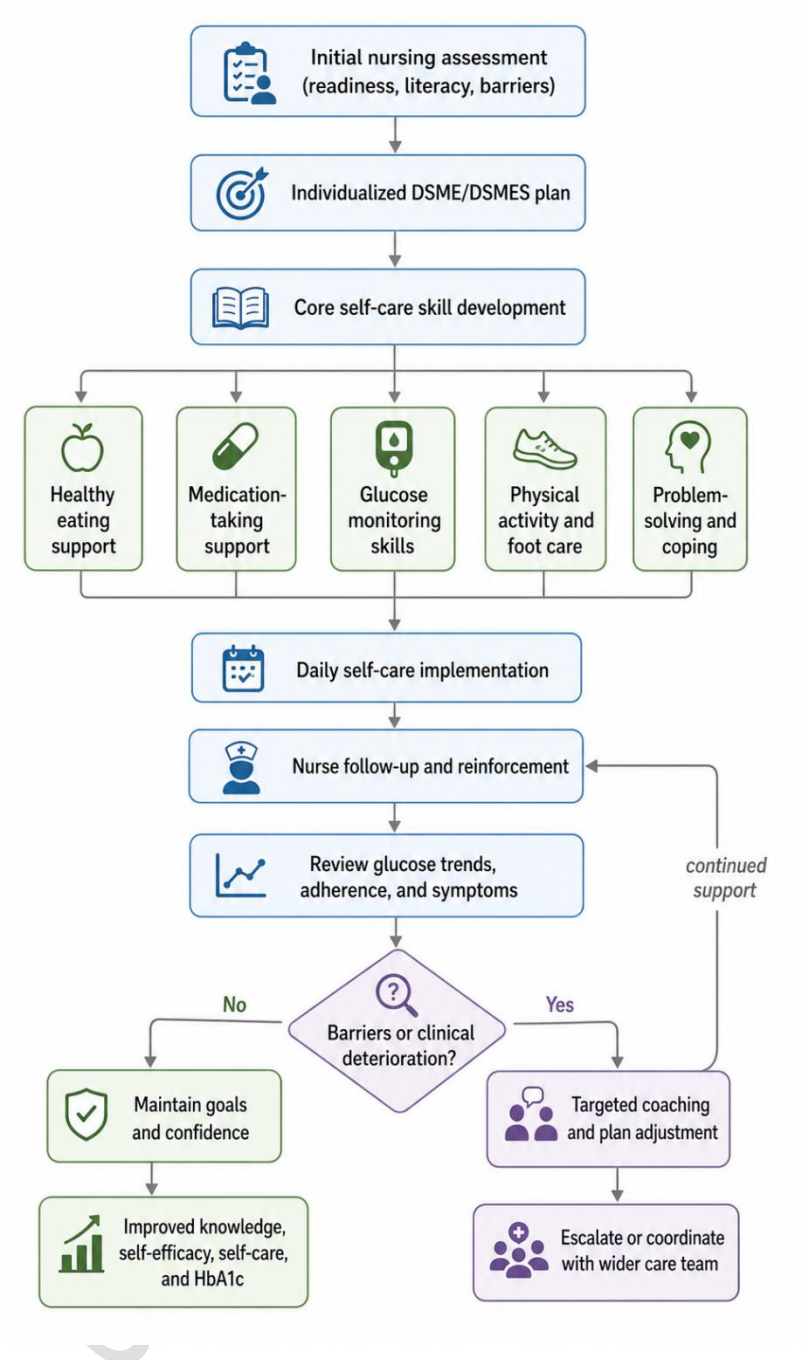
73. Diriba DC, Leung DYP, Suen LKP. Effects of family-based diabetes self-management education and support programme on support behaviour amongst adults with type 2 diabetes in Western Ethiopia. Sci Rep. 2023 Nov 27;13(1):20867. doi:10.1038/s41598-023-48049-w

74. Peña-Purcell NC, (Jay) Lee J, Ory MG. Integrating a Care Supporter in Diabetes Self-Management Education to Enhance Health Outcomes: A Pilot Study. Sci Diabetes Self-Manag Care. 2025 Apr;51(2):156–67. doi:10.1177/26350106251320327

75. Chen TT, Su WC, Liu MI. Patient-centered care in diabetes care-concepts, relationships and practice. World J Diabetes. 2024 Jul 15;15(7):1417–29. doi:10.4239/wjd.v15.i7.1417

76. Tarricone R, Petracca F, Svae L, Cucciniello M, Ciani O. Which behaviour change techniques work best for diabetes self-management mobile apps? Results from a systematic review and meta-analysis of randomised controlled trials. eBioMedicine. 2024 May;103:105091. doi:10.1016/j.ebiom.2024.105091

Figure 1. Nurse self-care support flowchart.



This flowchart illustrates the nurse-led DSMES process from initial assessment and individualized planning through skill development, implementation, follow-up, and response to barriers or clinical deterioration. It shows how nurses reinforce self-care behaviors, review glucose trends and adherence, and provide either maintenance support or targeted escalation when needed.

998 ***Table 1. Educational Strategies Used by Nurses in DSMES Programs***

Educational Strategy	Primary Role in DSMES	Key Implementation Considerations	Supporting References
Individualized nurse assessment and tailored teaching	Aligns education with the treatment regimen, health literacy, motivation, readiness for change, and self-care deficits	Assess confidence, behavioral barriers, and social context; tailor education to individual needs rather than providing generic recommendations.	[18,37,39]
Structured curriculum delivered by trained educators	Enhances consistency, reproducibility, and quality of DSMES delivery	Use standardized curricula, educator training, outcome monitoring, and quality-assurance processes.	[18,37]
Group teaching and peer-supported learning	Promotes social support, normalization of challenges, accountability, and shared problem-solving	Most effective when integrated into structured DSMES and delivered through regular contact sessions.	[50]
Counseling and motivational interviewing	Supports self-efficacy, behavior maintenance, and management of psychological barriers	Particularly useful when barriers are motivational or emotional rather than informational; effectiveness increases with ongoing follow-up.	[43,44]
Demonstrations and skills rehearsal	Develops practical competence in glucose monitoring, medication administration, and foot care	Consider as an active intervention component rather than a supplementary educational aid.	[37,46]
Culturally tailored and family-supported education	Improves relevance, acceptability, and sustainability of self-management behaviors	Adapt educational content to dietary customs, family structures, health beliefs, and socioeconomic context.	[54]
Phone-, SMS-, app-, and hybrid-based follow-up	Extends nursing support between clinic visits and promotes ongoing behavioral reinforcement	Most effective when technology supplements nurse-patient interaction through reminders, monitoring, and feedback.	[14,47,55]
Behavior-change techniques embedded in digital tools	Supports adherence, self-monitoring, and action planning	Self-monitoring functions, medication reminders, and action-planning features are associated with improved glycemic outcomes.	[76]
Workflow and referral interventions	Improves DSMES enrollment, participation, and completion rates in routine care	Integration into clinical workflows and referral pathways is essential for maximizing program reach and effectiveness.	[35]

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1000 ***Table 2. Recent Key Evidence on Clinical and Behavioral Outcomes of Nurse-Led DSMES***

Citation	Design	Population	Nurse-led details	Main outcomes and effect sizes
Romadlon et al, 2024 [16]	Systematic review and network meta-analysis of 108 studies	Adults with type 2 diabetes; 17,735 participants	Not exclusively nurse-led; compares DSME, DSMS, and DSMES	DSMES vs usual care: HbA1c −0.61%; FBG −23.33 mg/dL; SBP −3.05 mmHg; DBP −2.15 mmHg. DSMES outperformed DSME for HbA1c by −0.23%.
Ma et al, 2026 [34]	Umbrella review of meta-analyses	Type 2 diabetes	Broad DSME evidence synthesis	DSME had a significant positive effect on HbA1c; heterogeneity remained important. The review supported integrated multimodal models.
Sun et al, 2025 [12]	Systematic review and meta-analysis of RCTs	Adults with type 2 diabetes	Nurse-led DSME, at least 3 structured sessions	HbA1c: −0.92% at 4–6 months and −0.54% beyond 6 months; FBG −0.20; self-efficacy SMD 1.48; HDL improved; heterogeneity was high.
Makhfudli et al, 2025 [55]	Systematic review and meta-analysis of 11 RCTs	Community-dwelling adults with type 2 diabetes; 2,943 participants	Nurse-led digitalized diabetes management programs	Self-care SMD 1.15; QoL SMD 0.65; HbA1c −0.25%.
Alhaiti et al, 2025 [14]	Systematic review	Adults with type 1 or type 2 diabetes	Nursing-led technology-enabled interventions, including telehealth, SMS, apps, and telemonitoring	Multiple studies showed improved HbA1c and FBG. The strongest effects were reported in intensive, nurse-coordinated models.
Yimer et al, 2025 [33]	Systematic review and meta-analysis	Adults with type 2 diabetes in the WHO African Region	DSMES interventions, mixed delivery models	DSMES was moderately effective for blood glucose control; most interventions showed statistically significant HbA1c benefit.
Yu et al, 2022 [37]	Multicenter randomized controlled trial	Newly diagnosed type 2 diabetes; 128 participants; four tertiary hospitals in Xi'an	4-week nurse-led structured education, theory-based, group format	Improved fruit and vegetable intake, reduced high-fat food intake, better glucose monitoring, foot care, and medication management; HbA1c β −0.32%; self-efficacy improved.
Diriba et al, 2024 [54]	Pilot randomized controlled trial	Adults with type 2 diabetes in Western Ethiopia; 76 participants	Nurse-led, culture-tailored, community-based, family-supported DSMES	Self-management practice improved with large effect sizes postintervention and at 2 months; QoL improved at 2 months.

Cengiz et al, 2023 [39]	Randomized controlled trial	Turkish adults with type 2 diabetes; 51 participants	Individually delivered nurse-led personalized engagement intervention with in-person sessions, phone consultation, and written exercises	Treatment adherence, self-efficacy, and patient engagement improved at follow-up, with large effect sizes.
İşleyen et al, 2025 [43]	Randomized controlled trial	Adults with type 2 diabetes; 70 participants	Eight-session tele-nursing motivational interviewing	Self-efficacy and self-management improved; FBG and triglycerides decreased; HbA1c improved only at post-test.
Asante et al, 2025 [47]	Randomized controlled trial	Adults with type 2 diabetes in Ghana	3-month nurse-led mobile phone intervention plus usual care	High implementation fidelity; the trial reported favorable direction for glycemic variability and self-management outcomes.
Polat et al, 2026 [46]	Randomized controlled trial	Adults with type 2 diabetes; 48 participants	Hybrid foot self-management program using face-to-face sessions, WhatsApp, YouTube, and follow-up	Knowledge F 37.50; foot care behavior F 12.8; foot self-efficacy F 3.87; no improvement in chronic-illness adaptation.
Changsieng et al, 2023 [36]	Cluster randomized controlled trial	Thai adults with uncontrolled diabetes in community hospitals	Nurse-led supportive education after self-care deficit assessment	Improved self-care behavior and HbA1c according to the trial abstract and journal record.
Lalani et al, 2026 [42]	Retrospective cohort	13,087 patients in routine care	DSMES participation documented in real-world care	HbA1c declined by 1.03% over 24 months among DSMES participants, 0.19% more than non-participants.
Hu et al, 2025 [62]	Systematic review and meta-analysis	Adults with type 2 diabetes	Nurse-led psychological interventions	Diabetes distress reduced (SMD −0.36); depression and HbA1c findings were inconsistent.

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