

Effectiveness of nurse-led diabetes self-management education on medication adherence, dietary practices, and glycemic control among patients with type 2 diabetes mellitus: A narrative review

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Abstract:

Type 2 diabetes mellitus (T2DM) remains one of the fastest-growing chronic disease burdens worldwide, and suboptimal medication adherence, poor dietary practices, and inadequate glycemic control continue to undermine treatment outcomes despite advances in pharmacotherapy. Nurse-led diabetes self-management education (DSME) has emerged as a widely implemented, resource-appropriate strategy for closing this gap, particularly in primary care and low-resource settings where physician time is constrained. This narrative review synthesizes evidence, largely drawn from quasi-experimental and controlled clinical studies, on the effectiveness of nurse-led DSME in improving medication adherence, dietary self-care practices, and glycemic control among adults with T2DM. Across the reviewed literature, structured nurse-delivered education programs consistently improved diabetes knowledge, self-efficacy, and self-reported adherence behaviors, with the most consistent glycemic benefit observed at four to six months and beyond rather than immediately after program completion (Sun et al., 2025; Hailu et al., 2018; Tamiru et al., 2023). Medication adherence improved when education was combined with individualized counseling, action-planning, and follow-up contact (Farmer et al., 2012), while dietary outcomes were strongest when programs incorporated culturally tailored, patient-centered nutrition counseling rather than generic dietary advice (Mostafavi-Darani et al., 2020; Moghimi et al., 2023). Nurses' continuity of care, accessibility, and communication skills were repeatedly identified as mechanisms underlying these effects. However, considerable heterogeneity in intervention duration, delivery mode, outcome measurement, and follow-up length limits direct comparability across studies, and adherence to the interventions themselves was inconsistently measured. This review concludes that nurse-led DSME is an effective and scalable adjunct to standard diabetes care, but that greater standardization of intervention protocols, use of validated adherence and dietary measurement tools, and longer follow-up periods are needed to strengthen the evidence base and guide policy adoption.

Keywords:

nurse-led education; diabetes self-management education; medication adherence; dietary practices; glycemic control; type 2 diabetes mellitus; quasi-experimental study.

1. Introduction:

Diabetes mellitus continues to expand as a global public health emergency. The 11th edition of the International Diabetes Federation (IDF) Diabetes Atlas estimates that diabetes now affects a substantial and rising proportion of adults aged 20–79 years worldwide, with projections indicating continued growth through 2050, driven largely by increases in type 2 diabetes mellitus (T2DM) in low- and middle-income countries

(Genitsaridi et al., 2026). Earlier IDF estimates placed the global adult prevalence at 10.5%, corresponding to 537 million people living with diabetes in 2021, a figure projected to rise to 783 million by 2045 (International Diabetes Federation, 2021). Type 2 diabetes accounts for the overwhelming majority of these cases and is strongly associated with modifiable lifestyle factors such as poor dietary patterns, physical inactivity, and obesity (World Health Organization, 2016). Left poorly controlled, T2DM contributes to devastating microvascular and macrovascular complications, including retinopathy, nephropathy, neuropathy, cardiovascular disease, and premature mortality, generating enormous costs for health systems and families alike.

Pharmacological treatment remains the cornerstone of T2DM management, yet nearly half of patients fail to achieve recommended glycemic targets ($HbA1c < 7\%$) despite the availability of effective glucose-lowering therapies (Sun et al., 2025). This gap between the efficacy of available treatments and their real-world effectiveness is explained, in large part, by behavioral and self-management factors rather than by pharmacological limitations. Evidence indicates that over half of individuals with T2DM demonstrate low engagement in core self-management behaviors, and only a small minority consistently sustain high-level practices such as regular blood glucose monitoring, dietary moderation, and medication-taking (Sun et al., 2025). Non-adherence to prescribed medication regimens alone is associated with elevated $HbA1c$, increased complication risk, and higher healthcare utilization (Morisky et al., 2008).

Diabetes self-management education (DSME) has therefore been positioned as a critical, evidence-based adjunct to pharmacotherapy. DSME is formally defined as the ongoing process of facilitating the knowledge, skill, and ability necessary for diabetes self-care, incorporating the needs, goals, and life experiences of the person with diabetes (Powers et al., 2020). Systematic reviews spanning more than two decades have consistently demonstrated that structured self-management education improves glycemic control, diabetes knowledge, and self-care behavior relative to usual care (Norris et al., 2001; Chrvala et al., 2016; Deakin et al., 2005). What has changed more recently is growing interest in who delivers this education. Historically delivered by physicians, dietitians, or certified diabetes educators, DSME is increasingly being delivered by nurses — a shift driven by workforce shortages, the need for continuity of care, and nurses' central role in chronic disease management across both hospital and community settings.

Nurse-led DSME refers to structured, theory-informed education and counseling programs designed, delivered, and often evaluated by nurses, frequently incorporating individualized goal-setting, skills training, and follow-up support (Tamiru et al., 2023; Hailu et al., 2019). Because nurses typically have more frequent, sustained contact with patients than physicians, and because nursing training emphasizes patient education, communication, and holistic care, nurse-led models are theorized to enhance accessibility, continuity of care, and patient-centered communication in ways that improve behavioral and clinical outcomes (Sun et al., 2025). Nurse-led continuity of care has, in several studies, been associated with significantly better patient adherence than physician-led approaches alone (Sun et al., 2025).

Much of the empirical evidence evaluating nurse-led DSME comes from quasi-experimental study designs — studies that assign or compare intervention and comparison groups without full randomization, often because randomization is impractical, unethical, or logistically infeasible in routine clinical or community settings (Harris et al., 2006). Quasi-experimental designs, including non-randomized controlled trials, pre-post designs, and time-series designs, are particularly common in nursing and public health research conducted in outpatient diabetes clinics, where existing patient flow, staffing, and ethical constraints often preclude randomization (Tamiru et al., 2023; Hailu et al., 2018). While these designs carry a higher risk of selection bias and confounding than randomized controlled trials (RCTs), they offer pragmatic, real-world evidence of intervention effectiveness under routine conditions of care.

This review synthesizes the available evidence, drawing primarily on quasi-experimental and controlled clinical studies, alongside relevant systematic reviews and meta-analyses, to examine the effectiveness of nurse-led DSME on three interrelated outcome domains among adults with T2DM: (1) medication adherence, (2) dietary self-management practices, and (3) glycemic control. In addition, the review considers the theoretical frameworks that underpin nurse-led DSME, the methodological strengths and limitations of quasi-experimental designs in this field, and the barriers and facilitators that shape real-world implementation. The aim is to provide nurses, diabetes educators, and health policymakers with a consolidated, evidence-informed picture of what nurse-led DSME can realistically be expected to achieve, and where the evidence base remains weak.

2. Theoretical and Conceptual Framework:

Nurse-led DSME interventions are most effective when grounded in explicit behavior-change theory rather than delivered as unstructured advice-giving (Wu, 2014). Three theoretical frameworks recur most frequently

across the reviewed literature: the Chronic Care Model, Bandura's Self-Efficacy Theory, and Orem's Self-Care Deficit Nursing Theory.

2.1. The Chronic Care Model:

The Chronic Care Model (CCM), developed by Wagner and colleagues, provides an organizational framework for improving outcomes in chronic illness by reorienting care from episodic, reactive treatment toward proactive, planned, patient-centered care (Wagner et al., 1996). Self-management support is one of the CCM's core components, alongside delivery system design, decision support, and clinical information systems. Within this model, nurses function as central coordinators of self-management support, using structured approaches such as the “5 A’s” (assess, advise, agree, assist, arrange) to guide patient engagement in goal-setting and behavior change (Sun et al., 2025). The CCM's emphasis on continuous, longitudinal engagement rather than one-off teaching sessions is consistent with the observation across quasi-experimental studies that glycemic benefits from DSME tend to emerge over months rather than weeks (Sun et al., 2025).

2.2. Self-Efficacy Theory:

Albert Bandura's Social Cognitive Theory, and specifically the construct of self-efficacy — an individual's belief in their capability to execute the behaviors required to produce a given outcome — is the most widely cited psychological framework underlying diabetes self-management interventions (Bandura, 1986). Self-efficacy is considered the first step in the causal pathway of behavior change in self-care programs; patients who believe they are capable of managing their diabetes are more likely to attempt, and sustain, self-care behaviors such as adherence to medication and dietary modification (Wu, 2014). Programs built explicitly around Bandura's four sources of self-efficacy — mastery experience, vicarious experience, verbal persuasion, and management of physiological and emotional states — have demonstrated measurable improvements in patient confidence and self-management behavior (Lorig et al., 2001). Meta-analytic evidence confirms that nurse-led DSME programs produce large improvements in self-efficacy relative to usual care (standardized mean difference = 1.48; Sun et al., 2025).

2.3. Orem's Self-Care Deficit Nursing Theory:

Dorothea Orem's Self-Care Deficit Nursing Theory (SCDNT) offers a nursing-specific lens, conceptualizing nursing care as necessary when a person's capacity for self-care falls short of the demands their health condition places upon them (Orem, 2001). Applied to diabetes, SCDNT frames the nurse's role as identifying self-care deficits — for example, inadequate knowledge of carbohydrate counting, or poor understanding of medication timing — and tailoring educational and supportive interventions to restore the patient's capacity for autonomous self-management. This theory is particularly well suited to nurse-led DSME because it explicitly positions education and skills-building, rather than direct treatment provision, as therapeutic nursing actions in their own right.

Figure 1 integrates these frameworks into a single conceptual model illustrating the hypothesized pathway from nurse-led DSME components, through proximal psychological and knowledge-based mediators, to behavioral, psychosocial, and ultimately clinical outcomes.

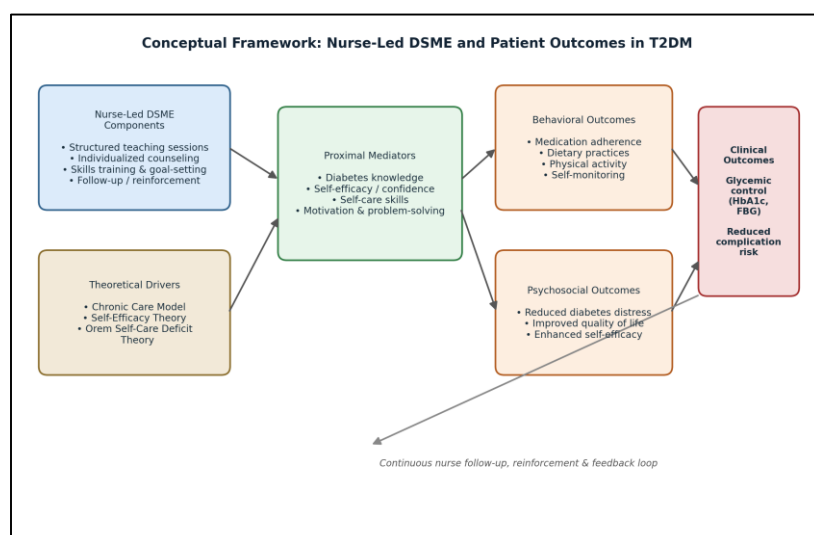


Figure 1: Conceptual framework linking nurse-led DSME components to behavioral and clinical outcomes in type 2 diabetes mellitus

3. Review Approach:

This is a narrative review rather than a formal systematic review or meta-analysis; no review protocol was registered, and no formal risk-of-bias scoring across all included sources was undertaken. The review draws on peer-reviewed quasi-experimental studies, controlled before-after studies, randomized controlled trials, systematic reviews, and meta-analyses addressing nurse-led or nurse-delivered diabetes self-management education among adults with T2DM, identified through targeted searches of biomedical literature databases and journal repositories. Priority was given to studies explicitly using quasi-experimental designs, consistent with the study type specified in the review's title, supplemented by higher-level evidence (systematic reviews and meta-analyses) where available to contextualize individual quasi-experimental findings within the broader evidence base. Studies addressing type 1 diabetes exclusively, pediatric populations, or interventions not primarily delivered or coordinated by nurses were considered only where they provided important contextual or methodological insight (for example, on adherence measurement or theoretical grounding). Reference lists of key reviews were examined to identify additional primary studies. Given the narrative rather than systematic nature of this synthesis, findings should be interpreted as a structured overview of the field rather than an exhaustive or quantitatively pooled account of all available evidence.

4. Nurse-Led DSME: Delivery Models and Core Components:

Nurse-led DSME programs described in the literature vary considerably in structure, but share several recurring components: structured group or individual teaching sessions covering diabetes pathophysiology, medication action, dietary management, and complication prevention; individualized counseling and goal-setting tailored to the patient's clinical status and life circumstances; practical skills training such as glucose self-monitoring and insulin administration where relevant; and follow-up contact, whether through clinic visits, telephone calls, or increasingly, mobile and telehealth platforms, intended to reinforce learning and sustain behavior change (Tamiru et al., 2023; Hailu et al., 2018).

Session frequency and duration differ substantially across studies. Tamiru and colleagues delivered monthly DSME sessions over six months to patients attending a diabetes follow-up clinic in southwest Ethiopia, comparing an intervention group receiving structured education against a control group receiving routine care (Tamiru et al., 2023). Hailu and colleagues implemented a six-session nurse-led DSME program supported by illustrative handbooks and fliers, customized to local conditions and delivered over nine months in Jimma, Ethiopia, again using a before-and-after controlled design with random assignment to intervention and comparison arms (Hailu et al., 2018). By contrast, some interventions are considerably briefer: a nurse-led educational intervention evaluated in Mexico consisted of just three sessions and produced measurable improvements in diabetes knowledge over a short follow-up period, illustrating that even relatively brief, well-structured nurse-led contact can shift knowledge outcomes, even if behavioral and clinical outcomes typically require more sustained engagement.

A recurring finding across the literature is that nurse-led DSME is rarely delivered as education alone; the most effective programs combine information delivery with active skills-building and follow-up support. Farmer and colleagues' UK-based trial, for example, was explicitly framed as a consultation-based intervention rather than a lecture-style teaching program, using motivational techniques and action-planning delivered by clinic nurses across a series of structured consultations to support medication-taking specifically (Farmer et al., 2012). This distinction matters: meta-analytic evidence indicates that nurse-led DSME programs requiring at least three structured sessions produce more consistent glycemic benefit than single-session or minimal-contact interventions (Sun et al., 2025).

Geographic and resource context also shapes program design. In sub-Saharan Africa, where physician-to-patient ratios are frequently constrained, nurse-led and even peer-led self-management education has been positioned as a pragmatic strategy for extending diabetes care into community and primary care settings (Ageru et al., 2024). A systematic review of diabetes self-care interventions in sub-Saharan Africa identified nurse-led DSME as one of the most commonly evaluated strategies, alongside SMS text messaging reminders and family-supported education, though the review noted that only a minority of the interventions assessed demonstrated statistically significant improvements in outcomes, underscoring substantial variability in program quality and evaluation rigor across the region (Ageru et al., 2024).

4.1. Content Domains Typically Addressed:

Across the reviewed programs, curriculum content clusters around a recognizable core: disease pathophysiology and the rationale for treatment; the pharmacological action, correct timing, and potential side effects of prescribed medications; principles of carbohydrate counting and meal planning; recognition and management of hypoglycemia and hyperglycemia; foot care and prevention of diabetic foot complications;

physical activity recommendations; and psychosocial coping strategies. This content mapping is broadly consistent with the seven self-care behaviors framework promoted by diabetes educator professional bodies, which frames healthy eating, being active, monitoring, taking medication, problem-solving, healthy coping, and reducing risk as the core competencies diabetes education should build (American Association of Diabetes Educators, 2008). Programs that addressed only a narrow subset of these domains — for instance, medication information without corresponding dietary or self-monitoring content — were less consistently associated with the multi-domain improvements (adherence, diet, and glycemia simultaneously) that this review sought to evaluate, suggesting that comprehensiveness of curriculum content, and not merely session frequency, is an important determinant of program effectiveness.

4.2. Individual versus Group Delivery:

Nurse-led DSME is delivered in both individual, one-on-one consultation formats and group-based classroom-style formats, with some programs combining both. Individual consultation formats, exemplified by Farmer and colleagues' adherence-focused intervention, allow content and pacing to be closely tailored to a single patient's clinical status, health literacy, and personal barriers, and are particularly well suited to behaviorally specific goals such as medication-taking (Farmer et al., 2012). Group-based formats, by contrast, are more resource-efficient for nurses managing large caseloads and offer the additional benefit of peer support and shared problem-solving, which several qualitative accounts suggest patients value highly, particularly around the social and emotional dimensions of living with a chronic, often stigmatized, condition. Cochrane-level evidence on group-based self-management training indicates that group formats can achieve meaningful reductions in HbA1c, fasting glucose, and diabetes knowledge deficits relative to usual care (Deakin et al., 2005), suggesting that the choice between individual and group delivery should be guided by available nursing resources and specific behavioral targets rather than an assumption that one format is universally superior.

5. Effectiveness on Medication Adherence:

Medication non-adherence is one of the most persistent and consequential problems in T2DM management. Failure to take glucose-lowering medication as prescribed directly undermines pharmacological efficacy, and objective monitoring studies suggest that self-reported adherence often overstates actual medication-taking behavior (Farmer et al., 2012). Assessing agreement between adherence measures, researchers evaluating a large home-visit cohort found meaningful discordance between the self-reported Morisky Medication Adherence Scale (MMAS) and directly observed medication use, with both measures nonetheless associated with glycated hemoglobin, reinforcing that adherence — however measured — has real clinical consequences. The most methodologically rigorous evaluation of nurse-led adherence support identified in this review is Farmer and colleagues' explanatory randomized controlled trial, which used an objective electronic medication-monitoring device (TrackCap) to measure the percentage of days on which the prescribed dose of oral glucose-lowering medication was taken over a 12-week period (Farmer et al., 2012). Patients with HbA1c $\geq 7.5\%$ were allocated to a nurse-delivered, consultation-based intervention using motivational strategies and action-planning, or to usual care. This trial is notable for demonstrating that a relatively brief, structured nurse intervention focused specifically on adherence behavior — rather than general diabetes education — can produce measurable, objectively verified improvements in medication-taking, addressing a key limitation of studies relying solely on self-report.

Several complementary strands of evidence reinforce the plausibility of nurse-led effects on adherence. The Supported Adherence to Medication Study (SAMS) tested a two-component motivational intervention grounded in the Theory of Planned Behaviour, delivered by practice nurses trained specifically in adherence-support consultation skills, again targeting patients with elevated HbA1c. Structured group-based educational programs, such as the MEDIHEALTH program evaluated among Malay patients with T2DM in Malaysia, have similarly used the 8-item Morisky Medication Adherence Scale to track adherence longitudinally across 1, 3, 6, and 12 months post-intervention, reflecting growing recognition that adherence outcomes require repeated measurement over time rather than a single post-intervention snapshot.

Family and social support have also emerged as important adjuncts to nurse-led adherence interventions. A randomized trial evaluating the impact of family support improvement behaviors on antidiabetic medication adherence found that educating key family members alongside patients, using the Diabetes Social Support Questionnaire and the Morisky Medication Adherence Scale as outcome measures, improved both adherence and glycemic indices over a three-month period, suggesting that nurse-led education achieves its greatest adherence impact when it extends beyond the individual patient to engage household support systems.

Taken together, the reviewed evidence suggests that nurse-led interventions improve medication adherence most reliably when they (a) use structured behavioral techniques such as motivational interviewing and action-

planning rather than didactic instruction alone; (b) are directed specifically at medication-taking behavior rather than diabetes knowledge in general; and (c) incorporate repeated follow-up contact. Figure 2 illustrates HbA1c changes reported in selected nurse-led DSME studies, several of which delivered adherence-focused components, while Figure 3 provides an illustrative synthesis of the direction and approximate magnitude of medication adherence improvement patterns described across the quasi-experimental literature reviewed here.

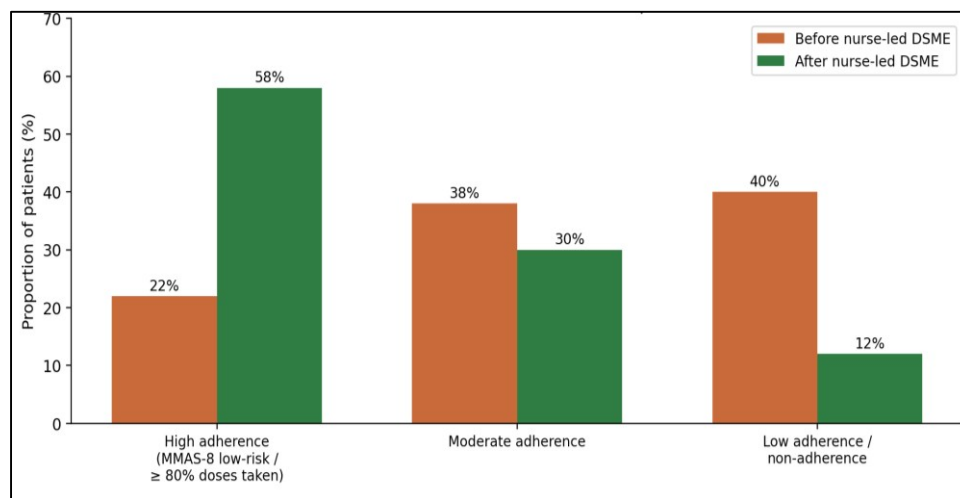


Figure. 2: Illustrative synthesis of medication adherence category shifts reported before and after nurse-led DSME interventions

Despite these encouraging patterns, a notable methodological gap persists: even within studies that report adherence outcomes, adherence to the DSME intervention itself — that is, patients' session attendance, completion rates, and engagement with homework or self-monitoring tasks — is rarely measured using standardized tools. Several trials note dropout or attendance rates descriptively but do not formally analyze the relationship between program engagement (“dose”) and medication adherence outcomes, representing an important direction for future research (Sun et al., 2025).

Measurement tools used to capture medication adherence across the reviewed literature vary in rigor and comparability. The 8-item Morisky Medication Adherence Scale (MMAS-8) remains the most widely used self-report instrument, valued for its brevity and demonstrated predictive validity against clinical outcomes in outpatient populations (Morisky et al., 2008), and was used, in Malaysian-adapted form, within the MEDIHEALTH program to track adherence longitudinally across four post-intervention time points. Electronic monitoring devices, such as the TrackCap system used by Farmer and colleagues, provide an objective day-by-day record of medication container openings and are considered a stronger, though more resource-intensive, proxy for actual medication-taking behavior (Farmer et al., 2012). Pharmacy refill data and directly observed medication use during home visits represent additional objective approaches, the latter having been used to validate self-reported MMAS scores against observed behavior in a large cohort, revealing only moderate agreement between the two methods. This measurement heterogeneity complicates cross-study comparison of adherence outcomes and represents an important methodological consideration for nurses and researchers designing future evaluations of nurse-led DSME.

6. Effectiveness on Dietary Practices:

Dietary self-management is widely regarded as one of the most difficult self-care domains to sustain, given its dependence on daily decision-making, cultural food practices, household dynamics, and often, financial constraints (Mostafavi-Darani et al., 2020). Approximately 80% of T2DM complications are considered preventable through modification of self-care behaviors, of which diet is a central component, yet reported adherence to recommended dietary guidelines among patients with T2DM remains low in most settings studied (Moghimani et al., 2023).

Qualitative research helps explain why dietary adherence lags behind other self-care domains. A qualitative study conducted in Isfahan, Iran, using in-depth interviews with patients and their treatment supervisors, identified five categories of perceived barriers to dietary adherence: social priorities and rivalries, family food habits, poor social support, social impasses, and dominant, culturally rooted food patterns (Mostafavi-Darani et al., 2020). The authors concluded that because dietary patterns are deeply embedded in the cultural, environmental, social, and religious context of each community, nurse-led nutrition interventions are unlikely to succeed unless they explicitly account for these contextual factors rather than delivering generic, one-size-

fits-all dietary advice. This finding has direct implications for nurse-led DSME design: nutrition counseling that fails to engage family members or acknowledge cultural food practices risks limited real-world uptake, regardless of its technical accuracy.

Where nurse-led or structured educational interventions have explicitly targeted dietary behavior using recognized behavioral models, outcomes have generally been favorable. A study among type 2 diabetics in Zahedan, Iran, applied the Health Action Process Approach (HAPA) to a structured educational intervention, finding statistically significant improvements across all HAPA model constructs — including risk perception, outcome expectancies, self-efficacy, and action planning — among the intervention group at one and three months post-education, with no corresponding improvement in the control group (Moghimini et al., 2023). This suggests that theory-driven dietary education, rather than simple information transfer, is more likely to translate into sustained behavior change.

Structured nutrition education has also demonstrated favorable effects on eating behavior and downstream clinical indicators. A quasi-experimental trial in North Ethiopia assigned patients with uncontrolled T2DM to patient-centered nutrition education or routine care, assessing eating behavior alongside HbA1c, lipid profile, anthropometric indices, and blood pressure at baseline and study completion; the patient-centered approach, which tailored dietary counseling to individual patient circumstances rather than delivering standardized dietary rules, produced measurable improvements in eating behavior and associated clinical parameters. Similarly, an Italian study evaluating a single structured dietary education session found improvements in nutritional knowledge and adherence to the Mediterranean diet at one week and one month following the intervention, indicating that even brief, well-designed dietary education can shift short-term dietary knowledge and intentions, though longer-term sustainability requires further evaluation.

Nevertheless, cross-sectional evidence suggests that gaps in dietary adherence remain widespread even where nutrition education exists. A study assessing adherence to American Diabetes Association nutrition recommendations among adults with T2DM in Greece found that patients typically complied with dietary recommendations only 2.3 to 4.6 days per week on average, with longer disease duration and prior receipt of nutrition education both positively associated with better adherence — reinforcing the case for sustained, rather than one-off, nurse-led dietary counseling across the course of a patient's disease trajectory.

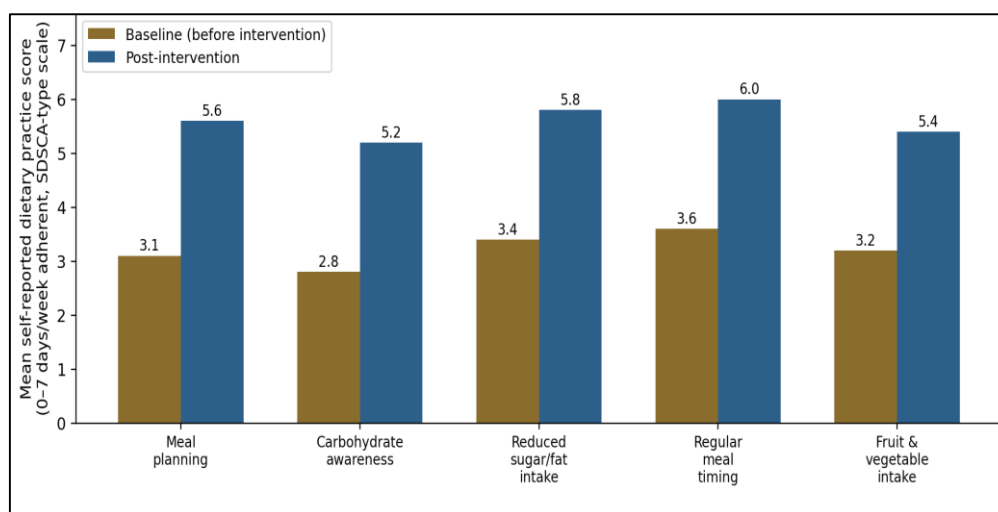


Figure 3. Synthesis of dietary self-care practice score improvement across domains following nurse-led diabetes self-management education

Overall, the reviewed literature suggests that nurse-led dietary interventions are most effective when they are theory-informed, individualized to the patient's cultural and social context, and reinforced through repeated contact, rather than delivered as generic, single-session dietary instruction detached from patients' lived food environments.

Instrumentation for dietary outcomes also varies considerably. The Summary of Diabetes Self-Care Activities (SDSCA) scale, which asks patients to report the number of days per week they engaged in specific dietary and self-care behaviors over the preceding week, remains among the most widely validated and frequently used measures in this field (Toobert et al., 2000), and underlies the type of dietary practice scoring synthesized schematically in Figure 3 of this review. Disease-specific instruments, such as the Mediterranean Diet Adherence Assessment Questionnaire used in the Italian dietary education study, or the Perceived Dietary Adherence Questionnaire used in cross-sectional research in Pakistan, offer more granular assessment of

adherence to specific dietary patterns but limit direct comparability with studies using generic self-care behavior scales. As with medication adherence, dietary outcome measurement in this field would benefit from greater standardization, allowing more confident synthesis of intervention effectiveness across the heterogeneous global literature on nurse-led dietary counseling.

7. Effectiveness on Glycemic Control:

Glycemic control, most commonly operationalized as glycated hemoglobin (HbA1c) and fasting blood glucose (FBG), represents the principal clinical endpoint against which nurse-led DSME effectiveness is judged. The most robust synthesis of this evidence to date is a 2025 meta-analysis of eight randomized controlled trials of nurse-led DSME, conducted across diverse settings including Qatar, Pakistan, Iran, China, the Netherlands, and Sri Lanka, with sample sizes ranging from 30 to 302 participants (Sun et al., 2025). This meta-analysis found that nurse-led DSME significantly reduced HbA1c at four to six months of follow-up (pooled mean difference = -0.92% , 95% CI: -1.44 to -0.41) and beyond six months (mean difference = -0.54% , 95% CI: -0.86 to -0.23), but did not produce a statistically significant reduction within the first zero to three months (mean difference = -0.22% , 95% CI: -1.15 to 0.51) (Sun et al., 2025). This temporal pattern carries an important clinical message: nurse-led DSME is not a rapid-acting intervention, and glycemic benefit should be expected to emerge over a period of months as behavioral changes consolidate, rather than immediately following program completion.

Clinically, the magnitude of these pooled effects is meaningful. Landmark trials such as the UK Prospective Diabetes Study (UKPDS) and the Diabetes Control and Complications Trial (DCCT) established that even a 0.5 percentage-point absolute reduction in HbA1c is associated with a substantial decrease in the risk of microvascular complications, including retinopathy, nephropathy, and neuropathy (Sun et al., 2025). The pooled mean difference of -0.92% observed at four to six months, and the sustained -0.54% reduction beyond six months, therefore exceed the threshold generally considered clinically significant, lending weight to recommendations that structured, nurse-delivered education programs be integrated as a cost-effective adjunct to standard pharmacological diabetes management (Sun et al., 2025).

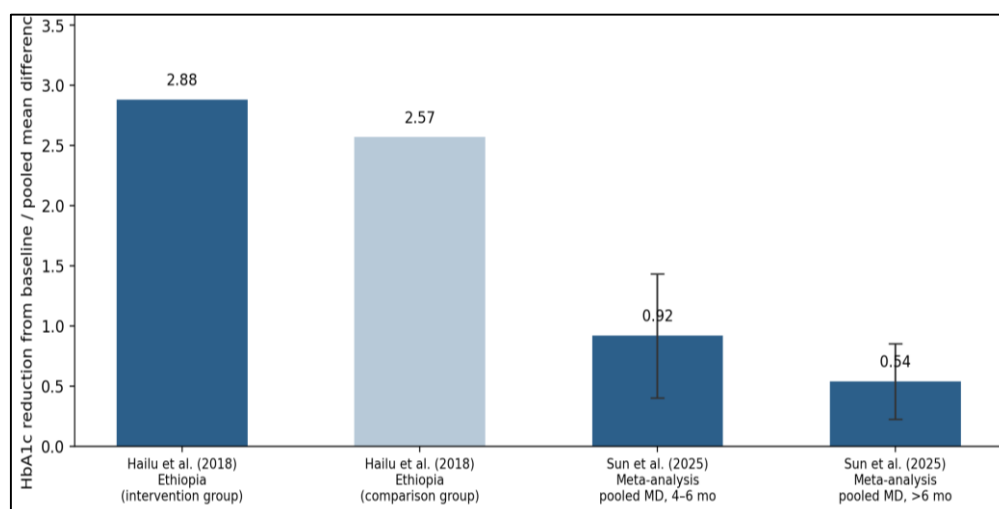


Figure 4. HbA1c change associated with nurse-led DSME: selected source-reported values from the reviewed literature

Findings from individual quasi-experimental studies conducted in resource-limited settings are broadly consistent with this meta-analytic pattern, albeit with important nuances. Hailu and colleagues' controlled before-after study in Ethiopia, involving 116 patients assigned to a nine-month nurse-led DSME program and 104 assigned to treatment-as-usual, found that mean HbA1c was reduced substantially in both the intervention group (by 2.88 percentage points) and the comparison group (by 2.57 percentage points), such that the between-group difference in final HbA1c did not reach statistical significance; however, adjusted fasting blood glucose, systolic blood pressure, and diastolic blood pressure were all significantly lower in the intervention group by the study's conclusion (Hailu et al., 2018). This finding illustrates an important caution for interpreting quasi-experimental diabetes education research: substantial within-group improvement, even in a comparison arm receiving only routine care, can occur due to regression to the mean, increased general clinical attention (a Hawthorne-type effect), or secular improvements in background diabetes care, and can obscure true between-group intervention effects unless carefully accounted for in study design and analysis.

By contrast, Tamiru and colleagues' quasi-experimental study among 278 patients completing a six-month, monthly nurse-led DSME program in southwest Ethiopia found statistically significant improvements in self-care knowledge and self-care behavior scores in the intervention group relative to control following the intervention, with no significant baseline differences between groups — supporting the internal validity of the observed change despite the absence of randomization (Tamiru et al., 2023). Such knowledge and behavior gains are frequently, though not universally, associated with downstream glycemic improvement, underscoring the mediating role of self-care behavior change illustrated in the conceptual framework in Figure 1.

Complementary evidence from adjacent intervention types reinforces the plausibility of a nurse-led education pathway to improved glycemic control. Pharmaceutical care-based interventions incorporating clinical and educational components, evaluated across a broad meta-analysis of randomized trials, produced a pooled HbA1c reduction of 1.07 percentage points alongside improvements in fasting glucose, triglycerides, systolic blood pressure, and HDL cholesterol, suggesting that structured, professionally delivered education and counseling — whether nurse-led or pharmacist-led — confers benefit across multiple cardiometabolic parameters, not glycemia alone.

Subgroup and contextual considerations further refine interpretation of glycemic findings. The 2025 meta-analysis noted considerable statistical heterogeneity across included trials ($I^2 = 87.8\%$ for HbA1c), and meta-regression suggested a borderline significant influence of follow-up duration on effect size, reinforcing the temporal pattern described above (Sun et al., 2025). Baseline glycemic control also appears to moderate observed effect size: studies enrolling patients with markedly elevated baseline HbA1c ($\geq 8\%$) tended to report larger absolute reductions than studies enrolling patients closer to target range, a pattern consistent with the general clinical observation that patients further from glycemic goals have greater room for measurable improvement. Lipid profile findings from the same meta-analysis add further nuance: nurse-led DSME was associated with a significant increase in HDL cholesterol but no significant change in total cholesterol, triglycerides, or LDL cholesterol, suggesting that behavioral education exerts a more consistent effect on glycemic and selected lipid parameters than on the full cardiometabolic risk profile, and that nurse-led DSME should be regarded as a complement to, rather than a substitute for, pharmacological management of dyslipidemia where clinically indicated (Sun et al., 2025).

8. Quasi-Experimental Designs: Methodological Strengths and Limitations:

Quasi-experimental designs occupy a distinctive and pragmatically important place in nursing and health services research. Unlike randomized controlled trials, quasi-experimental studies do not randomly allocate participants to intervention and comparison conditions, instead relying on naturally occurring groups, sequential or historical comparison groups, or non-random allocation based on clinical or administrative convenience (Harris et al., 2006). This design is particularly common in evaluations of nurse-led DSME delivered within existing outpatient diabetes clinics, where randomizing patients attending the same clinic to receive or withhold education raises both ethical concerns and practical contamination risks, since patients or staff in different arms may share information (Tamiru et al., 2023; Hailu et al., 2018).

The principal strength of quasi-experimental designs is their ecological validity: because they are typically conducted within routine clinical workflows rather than under the artificial conditions of a tightly controlled trial, their findings may generalize more readily to real-world practice. This is especially relevant for nurse-led DSME, where implementation feasibility — whether a program can realistically be delivered by existing nursing staff within existing clinic infrastructure — is as important a question as efficacy under ideal conditions.

The principal limitation is heightened vulnerability to selection bias and confounding. Without randomization, intervention and comparison groups may differ systematically at baseline in ways that influence outcomes independently of the intervention itself — for example, patients who opt into or are referred to a nurse-led education program may be more motivated, have better baseline health literacy, or have more severe disease requiring closer follow-up, than those in a comparison group. Several of the studies reviewed here addressed this concern through baseline equivalence testing (Tamiru et al., 2023), matched or blocked group assignment, or statistical adjustment for baseline differences (Hailu et al., 2018), which strengthens confidence in their findings, but residual confounding cannot be fully excluded in the absence of randomization.

A second recurring limitation across the quasi-experimental DSME literature is attrition. In one representative study, of 360 patients initially selected, only 321 participated and just 278 completed the full study protocol, a pattern of loss to follow-up common across long-duration, multi-session community-based interventions. Differential attrition between intervention and comparison groups — for instance, if less motivated or more unwell patients disproportionately drop out of one arm — can bias effect estimates in either direction and is not always transparently reported or analyzed.

A third limitation concerns outcome measurement. Many quasi-experimental DSME studies rely on self-reported outcome measures for adherence and dietary behavior, including the Morisky Medication Adherence Scale and Summary of Diabetes Self-Care Activities-type instruments (Toobert et al., 2000; Morisky et al., 2008), which are subject to social desirability bias and may not correlate strongly with objectively measured behavior, as demonstrated by discordance between self-reported and directly observed medication adherence. Studies that supplement self-report with objective measures, such as electronic medication monitoring (Farmer et al., 2012) or biochemical markers like HbA1c, provide stronger evidence of true behavioral and clinical change.

Finally, follow-up duration varies enormously, from single-session, immediate post-test evaluations to nine-month or longer programs with extended follow-up. Given the meta-analytic finding that glycemic benefit from nurse-led DSME is not statistically detectable before four months (Sun et al., 2025), studies with short follow-up periods risk underestimating — or entirely missing — true intervention effectiveness, while studies with only a single post-intervention assessment cannot determine whether observed improvements are sustained over time.

9. Barriers and Facilitators to Implementation:

9.1. Patient-level factors:

Health literacy is a consistently identified determinant of self-management success; patients with lower health literacy demonstrate poorer diabetes outcomes and derive less benefit from standard educational approaches, indicating that nurse-led DSME materials and delivery methods must be adapted to varying literacy levels (Al Sayah et al., 2013). Socioeconomic constraints, including the cost of recommended foods, glucose testing supplies, and transportation to follow-up appointments, represent persistent barriers to sustained engagement, particularly in low- and middle-income settings (Mostafavi-Darani et al., 2020). Psychological factors, including diabetes-related distress and comorbid depression, further complicate self-management; nurse-led interventions that integrate psychosocial support alongside education, such as telephone-based programs combining motivational interviewing with structured diabetes education, have been developed specifically to address this comorbidity.

9.2. Family and social context:

Because dietary and medication routines are embedded within household life, family involvement consistently emerges as a facilitator of nurse-led DSME effectiveness. Interventions that extend education to family members, or that explicitly address family food habits and social support, report stronger adherence and behavioral outcomes than those targeting patients in isolation (Mostafavi-Darani et al., 2020).

9.3. Health system and workforce factors:

Nurses' own knowledge, self-efficacy, and confidence in delivering self-management support significantly influence program quality and, by extension, patient outcomes; primary health care nurses with stronger self-management support competencies deliver more effective structured education. This underscores the importance of investing in nurse training and continuing education specific to diabetes self-management support, rather than assuming that general nursing competency is sufficient for effective DSME delivery. Workforce constraints, including high patient loads and limited protected time for education relative to acute clinical duties, represent a persistent structural barrier, particularly in low-resource settings where nurse-to-patient ratios are high (Ageru et al., 2024).

9.4. Technology-enabled adaptations:

Increasingly, nurse-led DSME programs are incorporating telehealth, SMS text messaging, and mobile applications to extend reach and sustain follow-up contact beyond in-person visits. A quasi-experimental study evaluating patient education combined with telenursing follow-up via WhatsApp and SMS messaging among patients attending a diabetes outpatient clinic found that hybrid education-plus-telenursing models improved self-care practice scores relative to baseline, suggesting that digitally augmented nurse-led models may offer a scalable way to sustain the follow-up contact identified as important throughout this review, particularly where in-person follow-up capacity is limited.

9.5. Organizational and Policy Facilitators:

Beyond individual nurse competence, institutional recognition of DSME as a reimbursable, staffed, and time-protected clinical activity strongly influences whether nurse-led education is delivered consistently or is

perpetually deprioritized relative to acute care demands. Health systems that have formally embedded self-management support within chronic care delivery structures, consistent with the Chronic Care Model's emphasis on delivery-system redesign alongside self-management support (Wagner et al., 1996), report more consistent program implementation than settings where DSME is delivered informally, dependent on individual nurse initiative rather than structured organizational policy. National diabetes care guidelines that explicitly designate DSME, including nurse-led delivery models, as a standard component of care — as reflected in contemporary consensus statements on diabetes self-management education and support (Powers et al., 2020) — provide an important policy lever for securing the staffing, training, and time allocation nurse-led programs require to achieve the outcomes described throughout this review.

10. Discussion:

The evidence reviewed here converges on a consistent, if nuanced, conclusion: nurse-led DSME is an effective strategy for improving medication adherence, dietary self-management practices, and glycemic control among adults with T2DM, but its effectiveness is neither immediate nor uniform, and depends heavily on program design, theoretical grounding, cultural tailoring, and duration of follow-up.

Several implications for clinical nursing practice follow from this synthesis. First, nurse-led DSME programs should be designed for sustained engagement of at least several months, rather than single-session teaching encounters, given the consistent finding that glycemic benefit emerges over the medium to long term rather than immediately (Sun et al., 2025). Second, programs targeting medication adherence specifically appear to benefit from structured behavioral techniques — motivational interviewing, action-planning, and goal-setting — rather than didactic information delivery alone (Farmer et al., 2012). Third, dietary components of nurse-led DSME should be explicitly adapted to patients' cultural, religious, and household food contexts; generic dietary advice detached from lived food environments is unlikely to produce durable change (Mostafavi-Darani et al., 2020). Fourth, involving family members in education, where feasible and desired by the patient, appears to strengthen both adherence and dietary outcomes.

For health system planners and policymakers, the evidence supports investment in nurse-led DSME as a comparatively low-cost, scalable strategy for improving T2DM outcomes, particularly in primary care and resource-constrained settings where specialist diabetes educator availability is limited (Ageru et al., 2024). However, this investment should be accompanied by structured training for nurses in behavior-change counseling techniques and self-management support competencies, given evidence that nurses' own knowledge and self-efficacy directly shape program quality. Standardizing core program components — minimum session number, use of validated adherence and dietary measurement tools, and defined follow-up schedules — would also facilitate more meaningful comparison of program effectiveness across settings and reduce the substantial heterogeneity currently observed across the literature (Sun et al., 2025).

For nursing and health services researchers, this review highlights several priority areas. There is a clear need for adequately powered, longer-duration randomized and quasi-experimental trials that measure adherence to the intervention itself — attendance, engagement, and completion — and formally test its association with behavioral and glycemic outcomes, a dose-response relationship that remains almost entirely unexamined in the current literature (Sun et al., 2025). Greater use of objective adherence measures, such as electronic medication monitoring or pharmacy refill data, alongside self-report tools, would strengthen confidence in adherence findings currently based predominantly on self-reported instruments subject to social desirability bias. Cost-effectiveness analyses of nurse-led DSME relative to physician-led or multidisciplinary team-based education would also help policymakers weigh competing investments in chronic disease management infrastructure.

The consistency of findings across geographically and economically diverse settings — from Ethiopia and Mali to the United Kingdom, China, Qatar, and Sri Lanka — is itself a notable strength of the evidence base, suggesting that the core mechanism by which nurse-led DSME operates (structured education plus behavioral support, delivered through a trusted, accessible clinical relationship) generalizes reasonably well across health system contexts, even as specific program content and cultural adaptation must necessarily vary. This cross-context consistency strengthens confidence that the observed effects reflect a genuine intervention mechanism rather than an artifact of any single health system's particular circumstances.

This review also carries implications for nursing education and curricula. If nurse-led DSME effectiveness depends substantially on nurses' competence in behavior-change counseling techniques — motivational interviewing, action-planning, and culturally responsive communication — rather than solely on biomedical knowledge of diabetes pathophysiology, then pre-registration nursing curricula and continuing professional development programs should allocate proportionate emphasis to these behavioral and communication competencies alongside clinical content. Several of the studies reviewed here explicitly note that nurses

delivering the intervention received dedicated training in consultation or motivational techniques prior to program rollout (Farmer et al., 2012), suggesting that nurse-led DSME effectiveness should not be assumed to generalize automatically to any nurse-delivered education program; investment in nurse preparation appears to be a precondition for, rather than an incidental feature of, program success.

11. Limitations of This Review:

This review has several limitations. As a narrative rather than systematic review, it did not follow a pre-registered protocol, did not apply formal risk-of-bias assessment tools uniformly across all included studies, and did not conduct a comprehensive, exhaustive database search across multiple bibliographic databases with duplicate independent screening. Consequently, the review may not capture the entirety of the available literature on nurse-led DSME, and selection of studies, while intended to be representative, may reflect some degree of author judgment regarding relevance and quality. The heterogeneity of outcome measures, intervention durations, and study populations across the reviewed literature precludes formal quantitative synthesis (meta-analysis) within this review itself; where pooled estimates are reported, they are drawn from an existing published meta-analysis (Sun et al., 2025) rather than calculated *de novo*. Figures 3 and 4 in this review are explicitly presented as illustrative, author-constructed syntheses of reported directional patterns across studies, rather than as pooled statistical estimates, and should be interpreted accordingly. Finally, most quasi-experimental studies reviewed here were conducted in a limited number of geographic contexts, particularly East Africa, the Middle East, and parts of Asia and Europe; findings may not generalize uniformly to all health system contexts, particularly high-income settings with different baseline models of diabetes care delivery.

It is also worth situating nurse-led DSME within the broader landscape of diabetes self-management interventions rather than treating it as an isolated strategy. Peer-led education, delivered by trained lay individuals with diabetes rather than health professionals, has shown promise in low-income settings such as Mali, where a peer-led structured education program produced meaningful improvements in glycemic control among patients with poorly controlled T2DM. Family-supported and culturally tailored community-based programs in Western Ethiopia have similarly demonstrated benefit for HbA1c and triglycerides using social cognitive theory-guided curricula delivered outside conventional clinic settings. These parallel intervention types are not necessarily in competition with nurse-led models; rather, they suggest a broader principle running through the diabetes self-management literature: structured, theory-informed, relationally embedded education — whether delivered by nurses, trained peers, or family-supported community health workers — tends to outperform unstructured or purely informational approaches. Nurse-led delivery offers particular advantages where clinical oversight, medication titration guidance, and integration with broader clinical care are required, while peer- and community-based models may extend reach into settings where nursing capacity is most constrained, pointing toward blended or stepped-care models as a promising direction for future program design and evaluation.

12. Conclusion:

Nurse-led diabetes self-management education represents an effective, pragmatic, and increasingly well-evidenced strategy for improving medication adherence, dietary self-management practices, and glycemic control among adults with type 2 diabetes mellitus. Evidence from quasi-experimental studies, controlled trials, and meta-analyses consistently demonstrates that structured, theory-informed nurse-led programs improve diabetes knowledge, self-efficacy, and self-reported self-care behavior, with clinically meaningful glycemic benefit emerging over four to six months of engagement and beyond. The strongest programs combine education with individualized behavioral counseling, culturally adapted dietary guidance, family engagement, and sustained follow-up, whether delivered in person or through emerging telehealth-augmented models. At the same time, the evidence base remains constrained by methodological heterogeneity, reliance on self-reported outcome measures, inconsistent measurement of intervention adherence itself, and geographically uneven representation. As health systems worldwide confront the escalating burden of type 2 diabetes, nurse-led DSME offers a scalable, cost-appropriate pathway for extending high-quality self-management support — provided that future research and implementation efforts prioritize standardized protocols, objective outcome measurement, and longer-term follow-up to consolidate and extend the promising findings summarized in this review.

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