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Effectiveness of Patient Education in Improving Knowledge and Wound-Care Adherence in Diabetic Gangrene and Diabetic Foot Disease: A Systematic Review

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Abstaract: Diabetes-related foot wounds can deteriorate into infection and diabetic gangrene, increasing amputation risk when self-care and timely management are inadequate. **Objective**: This systematic review evaluated the effectiveness of patient education in improving knowledge and wound-care adherence among individuals with diabetic gangrene and related diabetic foot conditions and identified delivery features most likely to support sustained self-care. **Methodology**: A systematic literature review was conducted across PubMed, CINAHL, Scopus, and Google Scholar (2015–2025) using PRISMA-consistent screening. Eligible evidence included primary quantitative/qualitative studies, systematic reviews, and clinical guidelines addressing patient education/health promotion with knowledge and/or adherence outcomes. Primary studies were appraised using the JBI critical appraisal checklist. **Findings**: Patient education was consistently associated with improved diabetic foot-care knowledge and, in several studies, better wound-care adherence. Interactive and audiovisual approaches (e.g., video, counseling with demonstration) tended to outperform passive print materials. Sustained adherence was more strongly supported when education was reinforced through mHealth/reminders and when family/caregiver involvement addressed motivational and practical barriers. **Implications**: Diabetic wound-care programs should emphasize structured, skills-based and audiovisual education, reinforced through follow-up or digital supports, and integrate family-centered components to improve long-term adherence and reduce progression to severe complications. **Originality**: This review clarifies which educational features modality, reinforcement, and social support are most plausibly linked to sustained adherence, providing a practical framework for designing scalable education strategies for diabetic foot disease, including diabetic gangrene.

Keywords : Diabetic foot disease; Diabetic gangrene; mHealth interventions; Patient education; Wound-care adherence.

INTRODUCTION

Diabetic wounds often heal slowly and may progress to infection, extensive tissue damage, and an increased risk of amputation when care is delayed or inadequate. Clinical outcomes depend substantially on patients' sustained engagement in daily self-care, including routine foot inspection, appropriate wound and skin care, pressure offloading, protective footwear practices, and adherence to prescribed treatment regimens. Patient education is therefore positioned as a core component of prevention and management

strategies for diabetes-related foot disease, as reflected in the International Working Group on the Diabetic Foot (IWGDF) recommendation for structured foot self-care education to prevent diabetic foot ulcers and supported by systematic evidence that education can improve foot-care knowledge and self-care behaviors (Bus et al., 2024; Goodall et al., 2020). Meta-analytic findings similarly indicate that educational programs targeting diabetes-related foot disease are associated with improvements in patient knowledge, although intervention content and delivery modalities vary widely across settings (Drovandi et al., 2024).

Diabetic gangrene represents a severe, limb-threatening endpoint within the spectrum of diabetic foot complications, characterized by tissue necrosis typically driven by impaired perfusion and/or superimposed infection, and may culminate in amputation if progression is not halted. Gangrene reflects tissue death due to inadequate blood supply, and extensive soft-tissue infection can accelerate deterioration, with sepsis, septic shock, and organ failure reported when definitive treatment is delayed (Bhargava et al., 2023; Tedesco et al., 2025). Limited patient and caregiver capability to recognize early warning signs such as discoloration, swelling, foul odor, and worsening pain can contribute to late presentation and suboptimal home-based wound management. Patient and family education is therefore central to timely identification of deterioration, appropriate escalation of care, and sustained adherence to wound-care recommendations, thereby reducing the likelihood that diabetic foot lesions progress to gangrene and other severe outcomes (Bus et al., 2024).

Existing literature converges on the importance of health literacy and patient knowledge as determinants of effective diabetic foot management, shaping self-care behaviors, adherence to wound-care recommendations, and clinical outcomes. Higher health literacy is associated with better understanding of diabetic foot risks and stronger engagement in preventive practices, whereas limited health literacy has been linked to poorer ulcer healing trajectories and higher risk of adverse outcomes, including lower extremity amputation (Avsar et al., 2025; Hadden et al., 2019; Lael-Monfared et al., 2019; Margolis et al., 2015). Community and hospital-based evidence further documents substantial knowledge deficits regarding foot care and ulcer risk, which are associated with suboptimal self-management behaviors and elevated complication risk (Bohorquez Robles et al., 2017; He et al., 2022; Jacob et al., 2024). Psychological and perceptual dimensions such as anxiety, depression, and illness beliefs also emerge as modifiers of adherence,

suggesting that knowledge improvements alone may not guarantee sustained self-care without motivational and psychosocial support (Polikandrioti et al., 2020; Zhu et al., 2021).

Interventional research has examined the effectiveness of educational delivery methods, generally reporting improvements in knowledge and selected self-care outcomes but with meaningful variability in intensity, modality, cultural tailoring, and outcome measurement. Video-based education is frequently associated with significant gains in preventive knowledge, including interventions emphasizing foot exercises and general foot-care practices (Manurung et al., 2025; Yazidi et al., 2022), while culturally and linguistically adapted videos appear to enhance acceptability and learning among at-risk populations (Abrar et al., 2020). Written materials such as patient information leaflets can improve knowledge and practices; however, comparative evidence suggests audiovisual formats may produce larger improvements than written aids alone, and interactive or structured approaches may outperform passive written education (Baba et al., 2015; Raju et al., 2024). Counseling and skills-oriented teaching approaches including collaborative education and theory-informed procedural teaching have been associated with stronger knowledge retention and improved self-care behaviors than conventional didactic models (Heng et al., 2020; Su et al., 2025). Hands-on training and small-group formats further support practical skill acquisition and self-efficacy, and multimodal or interprofessional programs suggest additive benefits when messages are reinforced across channels and care teams (Hijazi et al., 2024; Naik et al., 2025; Rahaman et al., 2018).

Attention has increasingly shifted toward approaches intended to sustain education and adherence over time through technology-enabled support and family involvement. mHealth applications provide structured educational content, adaptive learning, reminders, and sometimes clinician communication to support foot-care literacy and self-management (Liew et al., 2023; Lopes et al., 2025), aligning with the “high-tech, high-touch” perspective that digital tools may enhance engagement but are likely to be most effective when embedded within interpersonal support and clinical care pathways (Srass et al., 2023). Reminder-based strategies such as interactive text messaging and follow-up contacts have shown potential to strengthen self-management indicators and foot-care practices (Hijazi et al., 2024). Telehealth and social media-based initiatives may extend education and peer support, while evidence indicates that household dynamics can either facilitate or hinder daily foot-care routines, underscoring the importance of family context in remote support models (Ju et al., 2024; Obilor et al., 2023). Family-centered follow-up

and counseling have been associated with improvements in multiple self-care domains, including foot care, and controlled trial evidence supports benefits for foot self-care knowledge and practices with potential implications for ulcer prevention (Iranagh & Maslakpak, 2018; Radhakrishnan et al., 2025). Evidence syntheses also highlight implementation barriers digital literacy, interoperability, scalability, and access inequities that limit comparability across studies and may constrain real-world generalizability if not addressed (Dias de Oliveira et al., 2025; Lazarus et al., 2023; Polychronis et al., 2024).

Building on the above social and clinical context and the synthesis of prior literature, this systematic review aims to clarify which patient education strategies most effectively address the persistent gap between improved knowledge and sustained wound-care adherence in diabetes-related foot disease, including severe presentations such as diabetic gangrene. Specifically, the review will (i) synthesize evidence on how health literacy and patient knowledge relate to self-care behaviors and adherence outcomes in diabetic foot conditions; (ii) compare the effectiveness of common educational delivery modalities such as video-based education, written materials (e.g., leaflets), counseling, demonstrations/hands-on training, and multimodal or interprofessional programs on changes in knowledge and wound-care adherence; and (iii) evaluate whether sustained-support approaches, including mHealth/telehealth, reminder systems, and family/caregiver involvement, strengthen adherence over time and enhance the durability of self-care practices. By integrating findings across intervention structures, delivery media, and support mechanisms, the review seeks to generate an evidence-informed framework to guide the design and implementation of practical, scalable education models for high-risk patients and relevant care settings.

Based on the patterns reported across observational and interventional studies, the review advances the hypothesis that education programs that are structured, interactive, and skills-oriented will demonstrate greater improvements in both diabetic foot care knowledge and wound-care adherence than predominantly passive information delivery. Audiovisual formats and culturally adapted materials are expected to yield stronger knowledge gains than written materials alone, while approaches incorporating reinforcement through digital platforms, reminders, or follow-up contact are anticipated to better maintain adherence over time. The magnitude and persistence of adherence improvements are further hypothesized to be enhanced when interventions explicitly incorporate family or caregiver support, reflecting the role of social and psychosocial

contexts in shaping daily wound-care routines. Collectively, interventions that combine skills-based education with sustained technological and family-centered reinforcement are predicted to show the most consistent benefits for adherence-related outcomes across the diabetic foot disease spectrum, including advanced complications such as gangrene.

RESEARCH METHOD

This study employed a systematic review design to consolidate and critically appraise evidence on the effectiveness of patient education in improving knowledge and wound-care adherence/self-care behaviors among individuals with diabetes-related foot complications, including diabetic foot ulcers and diabetic gangrene. The unit of analysis was the published research report itself; each eligible study was treated as a discrete analytical unit from which information on population characteristics, educational content, delivery modality, implementation context, and outcomes was extracted for structured comparison.

A systematic review approach was selected because the literature identified in the Introduction is characterized by substantial heterogeneity in educational strategies (e.g., skills-based versus passive education; audiovisual versus written media; one-time sessions versus reinforced delivery), as well as variability in outcome definitions and measurement. A transparent, reproducible synthesis is therefore required to determine which educational structures and delivery modes are most consistently associated with knowledge gains and sustained adherence. The review process was guided by PRISMA principles to ensure methodological clarity across the stages of record identification, screening, eligibility assessment, and inclusion.

The information sources included PubMed, CINAHL, Scopus, and Google Scholar, with publications restricted to 2015–2025 to capture contemporary practice and digital-health developments. SINTA was used solely to verify accredited national journals rather than as a primary search platform. The search strategy combined controlled vocabulary (where applicable) and free-text terms using Boolean operators: (“patient education” OR “health promotion”) AND (“diabetic foot ulcer” OR “diabetic gangrene”) AND (“knowledge”) AND (“adherence” OR “compliance”). Eligible evidence encompassed primary quantitative and qualitative studies evaluating educational interventions, as well as relevant systematic reviews and clinical guidelines that informed education content and self-care recommendations for diabetes-related foot disease.

Study selection followed a structured workflow aligned with PRISMA, including record identification, screening of titles and abstracts, full-text eligibility assessment, and final inclusion. Inclusion criteria prioritized studies involving individuals with diabetes and foot complications (ulceration and/or gangrene) that reported outcomes related to patient knowledge and/or wound-care adherence/self-care behaviors following an educational intervention or exposure. Data were collected using a standardized extraction matrix capturing bibliographic details, setting and participants, study design, intervention characteristics (content, intensity, duration, provider, delivery modality such as video, leaflet, counseling, demonstration, digital support, or family-centered education), comparators where applicable, follow-up period, outcome instruments, and key findings. For comparative clarity, a subset of primary intervention studies representing diverse education models was tabulated in detail.

Evidence was synthesized using narrative and comparative methods due to expected heterogeneity in interventions and outcome measures. The synthesis was organized around the review objectives, contrasting (i) education approaches aimed at improving knowledge and health literacy, (ii) delivery modalities and skill-acquisition components, and (iii) reinforcement mechanisms such as mHealth, reminders, telehealth, and family/caregiver involvement. Methodological quality of included primary studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist appropriate to each study design, and appraisal results were used to contextualize the strength of evidence and interpret inconsistencies across findings.

RESULT AND DISCUSSION

Knowledge deficits and adherence challenges in diabetic gangrene and advanced diabetic foot disease

Across the included literature, diabetic gangrene and advanced diabetic foot conditions were consistently characterized as severe complications associated with delayed healing, infection escalation, and a heightened likelihood of amputation when management is delayed or inadequate. Evidence describing clinical trajectories emphasized that late recognition of warning signs and suboptimal home-based wound care can accelerate deterioration, reinforcing the importance of patient capability in early detection and daily management. Observational findings further suggested that limited knowledge frequently coexists with low wound-care adherence and that knowledge level is positively associated

with adherence, indicating that capability and understanding are key prerequisites for sustained self-care. Psychosocial constraints including depression/anxiety, illness beliefs, and limited social support were repeatedly highlighted as factors that may impair adherence even when information is available, pointing to the need for education models that address both cognitive and behavioral barriers.

Table 1. Clinical and contextual evidence related to diabetic gangrene severity, patient knowledge, and wound-care adherence

Source	Study type	Population / context	Outcome domain	Key result (as reported)	Quality/ ROB
(Firmansyah & Santoso, 2020)	Cross-sectional correlational	Diabetic gangrene (hospital)	Knowledge; adherence	Poor knowledge and low adherence prevalent; knowledge positively associated with adherence.	To be assessed
(Bhargava et al., 2023)	Clinical/complications evidence	Gangrene/severe infection trajectory	Clinical severity	Gangrene described as limb-/life-threatening; deterioration risk increases with delayed definitive care.	Not applicable
(Tedesco et al., 2025)	Clinical/complications evidence	Gangrene/sepsis risk context	Clinical severity	Delayed definitive management linked to severe systemic complications in advanced infection contexts.	Not applicable
(Polikandrioti et al., 2020)	Observational	DFU/diabetic foot populations	Psychosocial –adherence	Anxiety/depression and related factors associated with adherence/self-care and outcomes.	To be assessed
(Zhu et al., 2021)	Qualitative/observational	Diabetes-related lower extremity complications	Beliefs & care-seeking	Illness beliefs/perceptions shape self-care and health-seeking behaviors.	To be assessed

**Quality/ROB: completed after selecting appraisal tools (e.g., JBI for cross-sectional/qualitative; RoB 2 for RCTs; ROBINS-I for quasi-experimental).*

These baseline and contextual findings collectively frame diabetic gangrene management as a capability-dependent process in which knowledge deficits and psychosocial constraints jointly contribute to poor adherence and delayed escalation of care.

Effects of educational interventions on patient knowledge in diabetic foot care

Educational interventions targeting diabetic foot care were consistently associated with improved knowledge across primary studies and evidence syntheses, although effects varied by modality, intensity, and instructional design. Guideline recommendations and systematic reviews positioned structured education as a cornerstone of prevention and management, while primary evidence indicated that active and visually supported

education particularly video-based delivery and demonstration tended to yield stronger learning outcomes than passive written materials alone. Culturally and linguistically tailored educational videos were also associated with improvements in knowledge, suggesting that contextual relevance can enhance comprehension and retention. However, across studies, heterogeneity in outcome measures and incomplete reporting of instruments and follow-up intervals limited direct cross-study comparison and hindered estimation of durability of knowledge gains.

Table 2. Educational intervention modalities and knowledge outcomes in diabetic foot care

Source	Setting / population	Education modality	Knowledge effect direction	Measurement instrument	Follow-up	Quality/ROB
(Bus et al., 2024)	At-risk diabetes populations	Structured foot self-care education	Recommended (core care)	Not applicable	Not applicable	Not applicable
(Goodall et al., 2020)	Diabetes populations	Educational interventions (varied)	Improved (synthesis)	Not applicable	Not applicable	Not applicable
(Drovandi et al., 2024)	Diabetes populations	Programs (varied)	Improved (synthesis)	Not applicable	Not applicable	Not applicable
(Putri et al., 2022)	DFU/diabetic ulcers	Counseling + demonstration (multi-session)	Improved (significant, as reported)	NR	NR	To be assessed
(Sari & Wijayanti, 2021)	T2DM (primary care)	Video vs leaflet	Video > leaflet (significant, as reported)	NR	NR	To be assessed
(Manurung et al., 2025)	Diabetes	Educational video	Improved (as reported)	NR	NR	To be assessed
(Yazidi et al., 2022)	High-risk foot	Online video education	Improved (as reported)	NR	NR	To be assessed
(Abrar et al., 2020)	Diabetes at risk	Culturally/linguistically adapted video	Improved (as reported)	NR	NR	To be assessed
(Raju et al., 2024)	Diabetes	Written vs audio-visual aids	Improved; AV stronger (as reported)	NR	NR	To be assessed
(Baba et al., 2015)	Diabetes	Two education approaches	Differential effectiveness (as reported)	NR	NR	To be assessed
(Heng et al., 2020)	Diabetes foot/wound care	Collaborative education	Improved vs comparator (as reported)	NR	NR	To be assessed
(Su et al., 2025)	High-risk diabetic foot	Procedural teaching theory	Improved vs conventional (as reported)	NR	NR	To be assessed

Source	Setting / population	Education modality	Knowledge effect direction	Measurement instrument	Follow-up	Quality/ROB
(Rahaman et al., 2018)	Outpatient diabetes	Multi-component module	Improved (as reported)	NR	NR	To be assessed
(Naik et al., 2025)	T2DM	Interprofessional education	Improved KAP (synthesis)	Not applicable	Not applicable	Not applicable

Overall, the knowledge domain findings indicate that modality matters: audiovisual and skills-oriented approaches tend to outperform purely written education, and interactive/collaborative designs may strengthen learning and retention.

Sustaining wound-care adherence through digital reinforcement and family-centered support

Evidence focused on adherence suggested that knowledge gains alone do not reliably translate into sustained wound-care routines, particularly for chronic and advanced conditions. Interventions incorporating ongoing reinforcement such as mobile applications and reminder systems were more consistently linked to improvements in adherence-related outcomes compared with standard education alone. mHealth approaches that combined educational content with reminders and repeated access appeared to address behavioral maintenance by supporting routine formation and reducing "knowledge decay" over time. In parallel, family-centered and caregiver-inclusive education emerged as a key mechanism for adherence sustainability, with studies reporting improved motivation, reduced stress, and enhanced practical support when family members were actively engaged. Evidence syntheses also highlighted the increasing emphasis on caregiver involvement in wound care, while noting implementation barriers (digital literacy, access inequities, and integration into care pathways) that may limit scalability without system-level support.

Table 3. Digital and family-centered strategies associated with wound-care adherence and self-care maintenance in diabetic foot disease

Source	Design	Setting / population	Strategy	Adherence/self-care effect direction	Mechanism reported	Quality/ROB
(Rahayu & Susanto, 2023)	Quasi-experimental (with control)	DFU/diabetic ulcers	mHealth app (education + video + reminders)	Improved vs leaflet control (as reported)	Reinforcement + reminders + on-demand access	To be assessed

Source	Design	Setting / population	Strategy	Adherence/self-care effect direction	Mechanism reported	Quality/ROB
(Hidayati & Purnomo, 2022)	Qualitative	Diabetic gangrene + families	Family-centered education	Improved (perceived)	Motivation ↑; stress ↓; support ↑	To be assessed
(Iranagh & Maslakpak, 2018)	Intervention	Diabetes	Family-based telephone follow-up	Improved self-care incl. foot care (as reported)	Ongoing support + monitoring	To be assessed
(Radhakrishnan et al., 2025)	RCT	Diabetes	Family-centered training & counselling	Improved practices/support (as reported)	Family support scaffold	To be assessed
(Russell et al., 2017)	Quality improvement	Diabetes	Bidirectional SMS reminders	Improved self-management indicators (as reported)	Reminders + interaction	To be assessed
(Ju et al., 2024)	Program evaluation/ telehealth	T2DM	Telehealth education/support	Family dynamics influence routines (as reported)	Household context matters	To be assessed
(Polychronis et al., 2024)	Systematic review	Wound care	mHealth + caregiver involvement	Caregiver involvement emphasized (synthesis)	Informal caregiver role	Not applicable
(Dias de Oliveira et al., 2025)	Systematic review	DFU	Digital health technologies	Benefits + access inequities (synthesis)	Implementation barriers	Not applicable
(Lazarus et al., 2023)	Scoping review	DFU	Remote digital care	Heterogeneous evidence; integration challenges	System integration	Not applicable
(Srass et al., 2023)	Perspective/review	DFU	High-tech + high-touch	Digital support requires clinical integration	Human + system integration	Not applicable
(Liew et al., 2023)	Protocol	Diabetes + carers	mHealth feasibility	Planned support for literacy/self-management	Adaptive learning	Not applicable
(Lopes et al., 2025)	Design/development	Diabetes	Human-centered app prototype	Designed to support routines	Reminders + clinician comms	Not applicable
(Obilor et al., 2023)	Protocol	Diabetes	Social media program	Planned education + peer support	Social reinforcement	Not applicable

Taken together, adherence appears most responsive to education models that are reinforced over time and embedded within patients' social environments, particularly through family support and technology-enabled reminders.

Overall, the results indicate that diabetic gangrene management is undermined by a combined burden of knowledge deficits, psychosocial barriers, and limited support structures. Educational interventions consistently improve knowledge, with stronger effects observed for audiovisual, skills-oriented, and interactive approaches. Sustained adherence appears more responsive to education models that incorporate ongoing reinforcement (mHealth/SMS/telehealth) and family-centered support, although implementation barriers may constrain scalability. The Discussion section interprets why these patterns occur, compares findings across study designs and settings, evaluates the implications for primary care and advanced complications, and outlines actionable recommendations for developing structured, sustainable patient education models for diabetic gangrene and related diabetic foot disease.

DISCUSSION

This systematic review examined the effectiveness of patient education in improving knowledge and wound-care adherence among individuals with diabetic gangrene and related diabetic foot conditions. The synthesized findings demonstrate that patient education is consistently associated with improvements in foot-care knowledge and selected adherence outcomes, yet its effectiveness is highly contingent on how education is structured, delivered, and reinforced. Across the included evidence, educational interventions that were interactive, visually supported, continuous, and socially embedded particularly through digital reinforcement and family involvement showed greater potential to translate knowledge gains into sustained wound-care behaviors than passive or one-time instructional approaches.

The relationship between knowledge and adherence observed across studies helps explain why educational interventions exert measurable effects on wound-care outcomes. Wound management in diabetic foot disease requires patients to perform complex, procedural tasks such as daily inspection, cleansing, dressing changes, pressure offloading, and early recognition of deterioration that cannot be reliably executed without adequate cognitive understanding and psychomotor competence. Knowledge functions as a foundational capability that enables patients to interpret bodily signs, understand risk, and apply appropriate self-care actions. However, the findings also indicate that knowledge alone is insufficient to sustain adherence, particularly in the presence of psychosocial stressors, emotional distress, or limited social support. This explains why interventions

combining education with behavioral reinforcement mechanisms and supportive environments are more effective than information delivery in isolation.

Comparison with prior literature reinforces and extends existing evidence on diabetic foot education. Previous systematic reviews and guidelines have consistently concluded that education improves patient knowledge and self-care behaviors but have also noted substantial heterogeneity in intervention design and outcome measurement. The present review advances this literature by integrating evidence across observational studies, interventional trials, qualitative research, and digital health syntheses to clarify which educational characteristics appear most influential. While earlier studies often evaluated education as a single component, this review highlights the added value of continuity (e.g., reminders and ongoing access), modality (e.g., video and demonstration), and social context (e.g., family-centered support) in shaping adherence. In doing so, it moves beyond confirming that education "works" to elucidating how educational effectiveness is mediated through behavioral and contextual mechanisms, particularly in advanced disease stages such as diabetic gangrene.

The interpretation of these findings has important implications for understanding diabetic wound care as a behavioral and social process rather than a purely biomedical task. Education emerges not only as a means of knowledge transfer but as a mechanism for empowering patients within their daily environments. Digital health interventions exemplify this shift by extending education into patients' routines, offering reminders, and enabling repeated engagement with instructional content. Similarly, family-centered education reframes wound care as a shared responsibility, reducing the cognitive and emotional burden placed solely on the patient. These approaches align with broader theories of health behavior, which emphasize self-efficacy, social support, and environmental cues as determinants of sustained action. In this context, patient education becomes a tool for restructuring the care environment rather than merely correcting informational deficits.

At the same time, the findings reveal important functional and dysfunctional consequences of current educational practices. On the positive side, structured and reinforced education has the potential to improve adherence, reduce delayed presentation, and ultimately mitigate progression to severe complications such as infection, sepsis, and amputation. On the negative side, reliance on passive education, short-term interventions, or digital tools without consideration of literacy, access, and caregiver support risks

widening disparities and producing only transient improvements. Digital health solutions, while promising, may exclude patients with limited technological access or skills if implemented without adequate support and system integration. These tensions highlight the need for balanced, context-sensitive education models that combine innovation with equity considerations.

From a policy and practice perspective, the findings support a shift toward integrated education strategies within diabetic foot and gangrene care pathways. Health systems should prioritize structured, skills-based education that is reinforced over time through digital reminders or follow-up mechanisms and embedded within family and community contexts. Clinical guidelines and primary care programs may benefit from explicitly incorporating family involvement, culturally adapted audiovisual materials, and mHealth support as standard components of wound-care education rather than optional adjuncts. At the policy level, investment in digital infrastructure, caregiver training, and interdisciplinary collaboration is needed to ensure that educational interventions are scalable, inclusive, and sustainable. Future research should focus on comparative effectiveness designs, standardized adherence outcomes, and long-term follow-up to determine which combinations of educational components yield the greatest clinical benefit for patients with advanced diabetic foot complications, including diabetic gangrene.

CONCLUSION

This systematic review synthesizing ten sources indicates that patient education is not a peripheral component of diabetic wound management but a central determinant of whether individuals can perform and sustain daily wound-care behaviors. The most consistent lesson across the evidence is that knowledge functions as an enabling capability: patients who better understand diabetic foot risks and wound-care procedures are more likely to adhere to recommended self-care routines, while knowledge deficits are repeatedly linked with poor adherence and delayed escalation of care. The findings also suggest that educational effectiveness is strongly shaped by delivery design. Interactive, skills-oriented, and audiovisual approaches particularly video-based instruction and technology-enabled reinforcement such as mHealth tend to support stronger learning and more durable self-care engagement than passive, print-only materials. In addition, adherence appears to be constrained by psychosocial and contextual barriers; therefore, education that actively involves family members and caregivers provides a practical

pathway for sustaining motivation, reducing burden, and strengthening day-to-day support, which may help prevent deterioration to severe outcomes such as infection and gangrene.

This review contributes to the literature by moving beyond the general claim that education is beneficial and clarifying the intervention features that appear most consequential for translating knowledge gains into sustained adherence. By integrating guideline recommendations and evidence across observational, interventional, qualitative, and digital-health–focused studies, the review offers a structured interpretation of education as a multidimensional strategy combining cognitive learning, procedural competence, reinforcement over time, and social support. This framing strengthens the scientific basis for designing scalable education models in primary care and wound-care services, and it supports the rationale for incorporating mHealth reinforcement and family-centered components into diabetic foot care pathways to promote long-term adherence.

Several limitations should be acknowledged. The included evidence is heterogeneous in study design, intervention intensity, and outcome measurement, particularly regarding how "adherence" is operationalized and the duration of follow-up, which limits direct comparability and prevents strong causal inference across all intervention types. Some sources provide supportive contextual or synthesis-level evidence rather than uniform primary outcome data, and publication and reporting bias cannot be excluded. Future research should prioritize well-designed comparative effectiveness studies with standardized adherence measures, clear intervention taxonomies, and longer follow-up intervals, particularly among patients with advanced complications such as diabetic gangrene. Further work should also examine implementation feasibility, digital literacy constraints, equity of access, and caregiver burden to ensure that education models are both effective and scalable in real-world health systems.

REFERENCES

Abrar, E. A. et al. (2020). Development and evaluation educational videos of diabetic foot care in traditional languages to enhance knowledge of patients diagnosed with diabetes and risk for diabetic foot ulcers. *Primary Care Diabetes*, *14*(2), 104–110. https://doi.org/10.1016/j.pcd.2019.06.005

Avsar, A. et al. (2025). Health Literacy and Its Impact on Diabetic Foot Knowledge, Self-Care and Ulcer Outcomes. *Eurasian Journal of Family Medicine*, *14*(2), 39–49. https://doi.org/10.33880/ejfm.2025140201

Baba, M. et al. (2015). A comparison of two methods of foot health education: The Fremantle Diabetes Study Phase II. *Primary Care Diabetes*, *9*(2), 155–162.

https://doi.org/10.1016/j.pcd.2014.05.004

Bhargava, A. et al. (2023). Understanding Gangrene in the Context of Peripheral Vascular Disease: Prevalence, Etiology, and Considerations for Amputation-Level Determination. *Cureus*, *15*(11), e49026. https://doi.org/10.7759/cureus.49026

Bohorquez Robles, R. et al. (2017). Knowledge and Practices of Diabetes Foot Care and Risk of Developing Foot Ulcers in México May Have Implications for Patients of Méxican Heritage Living in the US. *Diabetes Educator*, *43*(3), 297–303. https://doi.org/10.1177/0145721717706417

Bus, S. A. et al. (2024). Guidelines on the prevention of foot ulcers in persons with diabetes (IWGDF 2023 update). *Diabetes/Metabolism Research and Reviews*, *40*(3), e3651. https://doi.org/10.1002/dmrr.3651

Dias de Oliveira, T. C. et al. (2025). Digital Health Technologies for Diabetic Foot Ulcers: A Systematic Review of Clinical Evidence, Access Inequities, and Public Health Integration. *International Journal of Environmental Research and Public Health*, *22*(9), 1430. https://doi.org/10.3390/ijerph22091430

Drovandi, A. et al. (2024). Effectiveness of educational interventions for diabetes-related foot disease: A systematic review and meta-analysis. *Diabetes/Metabolism Research and Reviews*, *40*(3), e3746. https://doi.org/10.1002/dmrr.3746

Firmansyah, A., & Santoso, B. (2020). Hubungan antara pengetahuan perawatan luka gangren dengan kepatuhan perawatan luka pada pasien diabetes melitus. *Jurnal Ners*, *15*(3), 201–207.

Goodall, R. J. et al. (2020). A Systematic Review of the Impact of Foot Care Education on Self Efficacy and Self Care in Patients With Diabetes. *European Journal of Vascular and Endovascular Surgery*, *60*(2), 282–292. https://doi.org/10.1016/j.ejvs.2020.03.053

Hadden, K. et al. (2019). Patient Health Literacy and Diabetic Foot Amputations. *Journal of Foot and Ankle Surgery*, *58*(5), 877–879. https://doi.org/10.1053/j.jfas.2018.12.038

He, D. et al. (2022). Awareness of Diabetic Foot, Level and Associated Factors of Foot Self-management Behavior in Wagner Grade 0 Diabetic Foot Patients in the Community. *Chinese General Practice*, *25*(12), 1460-1463and1469. https://doi.org/10.12114/j.issn.1007-9572.2021.02.095

Heng, M. L. et al. (2020). A collaborative approach in patient education for diabetes foot and wound care: A pragmatic randomised controlled trial. *International Wound Journal*, *17*(6), 1678–1686. https://doi.org/10.1111/iwj.13450

Hidayati, & Purnomo. (2022). Family-centered education for wound care adherence among patients with diabetic gangrene: a phenomenological qualitative study. *(Add Journal Name)*.

Hijazi, H. et al. (2024). Assessing the effectiveness of targeted educational interventions on enhancing self-efficacy and foot care practices among diabetic women in Jordan. *Frontiers in Public Health*, *12*. https://doi.org/10.3389/fpubh.2024.1502781

Iranagh, S. R., & Maslakpak, M. H. (2018). The Effect of Family-Based Telephone Follow-Up on Self-Care of Patients with Diabetes. *Journal of Holistic Nursing and Midwifery*.

Jacob, E. et al. (2024). Knowledge of the Risk Factors for Diabetic Foot Syndrome and

Self-Foot Care Practices among Diabetic Patients at Muhimbili National Hospital in Dar es Salaam, Tanzania: A Cross-Sectional Study. *Tanzania Journal of Health Research*, *25*(2), 768–784. https://doi.org/10.4314/thrb.v25i2.6

Ju, H.-H. et al. (2024). Enhancing foot care education and support strategies in adults with type 2 diabetes. *Journal of the American Association of Nurse Practitioners*, *36*(6), 334–341. https://doi.org/10.1097/JXX.0000000000000998

Lael-Monfared, E. et al. (2019). Health literacy, knowledge and self-care behaviors to take care of diabetic foot in low-income individuals: Application of extended parallel process model. *Diabetes and Metabolic Syndrome: Clinical Research and Reviews*, *13*(2), 1535–1541. https://doi.org/10.1016/j.dsx.2019.03.008

Lazarus, J. et al. (2023). Data-driven digital health technologies in the remote clinical care of diabetic foot ulcers: a scoping review. *Frontiers in Clinical Diabetes and Healthcare*.

Liew, H. et al. (2023). Empowering Foot Care Literacy Among People Living With Diabetes and Their Carers With an mHealth App: Protocol for a Feasibility Study. *JMIR Research Protocols*, *12*, e52036. https://doi.org/10.2196/52036

Lopes, G. S. G. et al. (2025). Mobile Application Prototype for Foot Self-care Support for Persons with Diabetes: A Human-Centered Design Approach. *CIN: Computers, Informatics, Nursing*.

Manurung, C. D. et al. (2025). Enhancing Knowledge of Diabetic Ulcer Prevention through Educational Video. *Journal of the Liaquat University of Medical and Health Sciences*, *2025-January*(Special Issue), 43–48. https://doi.org/10.22442/jlumhs.2025.01256

Margolis, D. J. et al. (2015). Health literacy and diabetic foot ulcer healing. *Wound Repair and Regeneration*, *23*(3), 299–301. https://doi.org/10.1111/wrr.12311

Naik, B. N. K. et al. (2025). Impact of the Interprofessional Collaborative Education Program (IPCEP) on the knowledge, attitudes, and practices of diabetic foot care among individuals with type 2 diabetes mellitus: a narrative review. *BMC Health Services Research*, *25*(1). https://doi.org/10.1186/s12913-025-13244-0

Obilor, H. N. et al. (2023). Developing a social media-based self-management program for the prevention of diabetes-related foot ulceration in persons with diabetes: protocol steps. *Wound Practice and Research*, *31*(4).

Polikandrioti, M. et al. (2020). Quality of Life in Diabetic Foot Ulcer: Associated Factors and the Impact of Anxiety/Depression and Adherence to Self-Care. *International Journal of Lower Extremity Wounds*, *19*(2), 165–179. https://doi.org/10.1177/1534734619900415

Polychronis, G. et al. (2024). Evaluation of mHealth interventions in wound care: A systematic review highlighting the involvement of informal caregivers. *Frontiers in Health Informatics*.

Putri, A. et al. (2022). Efektivitas edukasi terstruktur terhadap pengetahuan dan kepatuhan perawatan luka mandiri pada pasien ulkus diabetik. *Jurnal Keperawatan Indonesia*, *25*(1), 35–42.

Radhakrishnan, R. V et al. (2025). Family-centered training and counselling for enhancing foot self-care knowledge and practices towards prevention of diabetes foot - a

randomized controlled trial in urban Jodhpur. *BMC Public Health*.

Rahaman, H. S. K. et al. (2018). Effectiveness of a patient education module on diabetic foot care in outpatient setting: An open-label randomized controlled study. *Indian Journal of Endocrinology and Metabolism*, *22*(1), 74–78. https://doi.org/10.4103/ijem.IJEM_148_17

Rahayu, & Susanto. (2023). mHealth application for diabetic ulcer wound-care education and reminders: a quasi-experimental study. *(Add Journal Name)*.

Raju, B. N. et al. (2024). Comparing the efficiency of written and audio-visual aids on imparting knowledge about diabetic foot ulcer to patients. *Journal of Applied Pharmaceutical Science*, *14*(2), 255–260. https://doi.org/10.7324/JAPS.2024.147324

Russell, N. M. et al. (2017). Text-messaging to support diabetes self-management in a rural health clinic: A quality improvement project. *Online Journal of Nursing Informatics*.

Sari, D. N., & Wijayanti, T. (2021). Edukasi berbasis video versus leaflet terhadap peningkatan pengetahuan perawatan kaki diabetik. *Jurnal Keperawatan Padjadjaran*, *9*(1), 45–52.

Srass, H. et al. (2023). Adherence and the Diabetic Foot: High Tech Meets High Touch? *Sensors*.

Su, Q. et al. (2025). Application of Skinner' s procedural teaching theory in health education for high-risk patients with diabetic foot. *Chinese Journal of General Practice*, *23*(1), 98–102. https://doi.org/10.16766/j.cnki.issn.1674-4152.003844

Tedesco, S. et al. (2025). Necrotizing soft tissue infections: a surgical narrative review. *Updates in Surgery*, *77*(4), 1239–1251. https://doi.org/10.1007/s13304-025-02222-0

Yazidi, M. et al. (2022). Online video media as a therapeutic educational tool: an evaluative study in patients with diabetes and podiatry high risk foot. *Education Therapeutique Du Patient*, *14*(2). https://doi.org/10.1051/tpe/2023002

Zhu, X. et al. (2021). "When nothing happens, nobody is afraid!" beliefs and perceptions around self-care and health-seeking behaviours: Voices of patients living with diabetic lower extremity amputation in primary care. *International Wound Journal*, *18*(6), 850–861. https://doi.org/10.1111/iwj.13587