South American Publishing

SAP Podiatry. 2026;3:277
doi: 10.62486/pod2026277

REVIEW

Foot care education for the prevention of diabetic foot ulcers

Educación en el cuidado del pie para la prevención de úlceras del pie diabético

Neisy Pérez Ramos[1]
Gabriela González Pernas[2]
Mariam Alejandra González González[2]
Andy Alonso Pazos[2]

[1] Universidad de Ciencias Médicas de Villa Clara, Facultad de Medicina, Departamento de Ciencias Biomédicas. Santa Clara, Cuba.
[2] Universidad de Ciencias Médicas de Villa Clara, Facultad de Medicina. Santa Clara, Cuba.

Submitted: 04-06-2026 | Revised: 02-08-2026 | Accepted: 26-10-2026 | Published: 31-10-2026

ABSTRACT

Diabetic foot ulcers represent a major complication of diabetes and contribute substantially to the risk of lower-limb amputation. Although educational strategies focused on foot care are commonly recommended as preventive measures, the available evidence varies considerably in methodological design and clinical context. This systematic review was conducted in accordance with PRISMA 2020 and examined studies published between 2018 and 2026, identified through Scopus, PubMed, OpenAlex, and Crossref. Eligible investigations evaluated structured foot care education among individuals with diabetes using randomized, quasi-experimental, or observational designs. A total of 18 studies involving 1,531 participants met the inclusion criteria, comprising five randomized controlled trials, twelve quasi-experimental investigations, and one observational cohort study. Across the included studies, educational interventions were consistently associated with improvements in foot care knowledge and self-management practices. However, only two investigations assessed outcomes directly related to ulceration or its complications. One randomized trial detected no difference in the occurrence of new ulcers following group-based education, while an observational cohort identified an association between previous educational exposure and lower rates of amputation and infection. Most quasi-experimental studies presented a high risk of bias, limiting confidence in their findings. Overall, structured foot care education appears effective in strengthening patients' knowledge and self-care behaviors, whereas its capacity to prevent diabetic foot ulcer development remains insufficiently demonstrated by the available low-certainty evidence.

Keywords: diabetic foot; foot ulcer; patient education; self care; diabetes mellitus; primary prevention.

RESUMEN

Las úlceras del pie diabético constituyen una complicación importante de la diabetes y contribuyen considerablemente al riesgo de amputación de las extremidades inferiores. Aunque las estrategias educativas orientadas al cuidado de los pies se recomiendan habitualmente como medidas preventivas, la evidencia disponible presenta una notable heterogeneidad en cuanto a los diseños metodológicos y los contextos clínicos. Se desarrolló una revisión sistemática conforme a las directrices PRISMA 2020, que examinó estudios publicados entre 2018 y 2026 e identificados mediante búsquedas en Scopus, PubMed, OpenAlex y Crossref. Se consideraron investigaciones aleatorizadas, cuasiexperimentales y observacionales que evaluaron intervenciones educativas estructuradas sobre el cuidado de los pies en personas con diabetes. Se incluyeron 18 estudios con un total de 1531 participantes, distribuidos en cinco ensayos aleatorizados, doce investigaciones cuasiexperimentales y un estudio de cohorte observacional. Las intervenciones educativas mostraron mejoras consistentes en los conocimientos sobre el cuidado de los pies y en las prácticas de autocuidado. Sin embargo, únicamente dos estudios evaluaron desenlaces relacionados directamente con la ulceración o sus complicaciones. Un ensayo aleatorizado no identificó diferencias en la aparición de nuevas úlceras después de una intervención educativa grupal, mientras que un estudio de cohorte observacional encontró una asociación entre la educación previa y menores tasas de amputación e infección. La mayoría de los estudios cuasiexperimentales presentaron un riesgo elevado de sesgo, lo que limita la confianza en sus resultados. En conjunto, la educación estructurada sobre el cuidado de los pies parece favorecer la adquisición de conocimientos y el fortalecimiento de las conductas de autocuidado, aunque su efectividad para prevenir la aparición de úlceras del pie diabético todavía no cuenta con evidencia suficientemente sólida, debido a la baja certeza de los hallazgos disponibles.

Palabras clave: pie diabético; úlcera del pie; educación del paciente; autocuidado; diabetes mellitus; prevención primaria.

© 2026; The Authors. This Open access article is distributed under CC BY 4.0 licence.

INTRODUCTION

Diabetic foot ulcers are among the most disabling and costly complications of diabetes mellitus. Between 19% and 34% of people with diabetes will develop a foot ulcer at some point in their lifetime, and foot ulcers precede the large majority of non-traumatic lower limb amputations. (1) The epidemiology is unevenly distributed: a systematic review and meta-analysis of the global epidemiology of diabetic foot ulceration estimated a pooled prevalence close to 6.3%, with wide variation across regions and study populations.(2) Lower and middle income countries carry a disproportionate share of the amputation burden, in part because neuropathy is detected late and because access to structured foot care is limited.(3) In Nigeria, a two-decade synthesis of diabetic foot ulcer outcomes documented persistently high amputation and mortality rates despite advances in wound care.(4) Beyond mortality and limb loss, ulcers reduce health-related quality of life, prolong hospital stays and consume substantial resources, so prevention remains a clinical and public health priority.

Foot ulceration is largely preventable because most ulcers arise from a recognizable sequence of modifiable events. Peripheral neuropathy abolishes protective sensation, minor trauma from ill-fitting footwear or incorrect nail care goes unnoticed, and delayed care-seeking allows a small lesion to progress.(5)Daily inspection, appropriate footwear, hygienic nail care and prompt consultation after minor injury are the behaviors that interrupt this sequence, and each of them can be taught. Structured education is therefore a cornerstone of the prevention pathway recommended by the International Working Group on the Diabetic Foot, which has advised, across successive guideline updates, that all people with diabetes receive instruction in foot self-care and that those at increased risk receive integrated foot care education delivered by trained providers. (5,6) The underlying assumption is behavioral: education raises knowledge and self-efficacy, and these constructs in turn sustain the daily behaviors that separate neuropathy from ulceration. This reasoning draws on social cognitive theory, which holds that knowledge alone is rarely sufficient to change a routine behavior and that perceived self-efficacy mediates the translation of information into action. Applied to the diabetic foot, an educational program is expected to teach the person what to inspect, why it matters and when to seek help, and to build the confidence to perform those actions consistently. Whether this chain actually reaches the endpoint of preventing a clinical ulcer is an empirical question rather than a theoretical certainty, and it is the question the present review set out to answer.

The evidence supporting this assumption is less settled than the guideline language suggests. A Cochrane review of patient education for the prevention of diabetic foot ulceration concluded that the available trials were underpowered and produced inconsistent estimates of ulcer incidence.(7)Later syntheses reported improvements in knowledge, self-efficacy and self-care behavior, but they relied heavily on uncontrolled before and after designs, pooled heterogeneous instruments and rarely distinguished behavior change from hard ulcer outcomes.(8-10)A scoping review of education programs to prevent diabetic foot ulcers and an umbrella review of foot care educational interventions reached similar conclusions about the breadth of formats and the weakness of the underlying designs.(11,12) Several of these syntheses are now aging relative to the rapid growth of digital, mobile and community-based education interventions published in the last three years, which have not been incorporated into a single structured synthesis.(13)The field has also shifted in geography: recent primary studies cluster in South and Southeast Asia and in sub-Saharan Africa, where the burden of ulceration and amputation is highest, so an update centered on the current literature is more relevant to those settings than reviews built mainly on trials from high-income countries. These gaps in currency, design coverage and geographic relevance justified a new systematic review.

The present review was undertaken to update and structure this evidence. The objective was to synthesize the evidence on structured foot care education for the prevention of diabetic foot ulcers and for the improvement of foot self-care in people with diabetes, with explicit attention to the designs and settings of the underlying studies. The review addressed the following PICOS question: in people with diabetes at risk of diabetic foot, do structured foot care education interventions, compared with usual care, no education or an alternative educational format, reduce the incidence of diabetic foot ulcers or improve foot self-care?

METHODS

Review framework and study selection

The review followed the PRISMA 2020 reporting standards.(14) Its scope encompassed educational interventions addressing foot care among individuals with diabetes mellitus, irrespective of whether they had an active, previously healed, or no history of foot ulceration. Publications from 2018 through 2026 were considered, provided they were available in English or Spanish.

Eligible interventions involved structured instruction on foot inspection, hygiene, appropriate footwear, nail and skin care, identification of warning signs, or timely consultation with healthcare services. Educational activities could be administered individually or collectively by healthcare personnel or nonprofessional educators, using printed materials, illustrations, audiovisual resources, mobile applications, or web-based platforms. Programs integrating foot care into broader diabetes self-management education were also considered when the relevant component could be distinguished.

The review accepted randomized controlled trials, quasi-experimental investigations with or without control groups, and observational cohorts evaluating previous exposure to foot care education. Comparisons included routine care, absence of educational intervention, and different educational approaches. Outcomes comprised new or recurrent diabetic foot ulceration, foot care knowledge, self-efficacy, and self-care practices. Protocols, editorials, narrative or systematic reviews, conference abstracts lacking extractable findings, and investigations exclusively involving healthcare workers, students, or caregivers were excluded.

Bibliographic retrieval

Four bibliographic resources were consulted: Scopus, PubMed, OpenAlex, and Crossref. Scopus provided the principal search framework, with additional retrieval undertaken through the other databases. The primary Scopus expression was:

TITLE-ABS-KEY("diabetic foot" AND (education OR "self-care" OR "self-management" OR "foot care")) AND PUBYEAR > 2017 AND PUBYEAR < 2027

To broaden retrieval, two further combinations were applied: TITLE-ABS-KEY("foot care education" AND diabetes) and TITLE-ABS-KEY("diabetic foot ulcer" AND (education OR "self-management") AND prevention), using identical publication-year limits.

Database-specific adaptations were implemented for the remaining sources. PubMed was searched using diabetic foot AND (education OR self-care OR self-management OR foot care) AND (ulcer OR prevention), restricted to publications dated 2018–2026. For OpenAlex and Crossref, the expression diabetic foot education self-care ulcer prevention was employed with corresponding date restrictions. Searches were confined to journal articles when supported by the database interface, without applying methodological design filters.

Screening and eligibility assessment

Bibliographic records were consolidated and duplicate entries identified through DOI matching and normalized titles. Screening proceeded from title and abstract assessment to examination of available full texts. Clearly irrelevant records were removed during the initial stage, with exclusion reasons documented, while potentially eligible or uncertain records advanced to retrieval.

Of 64 records selected for full-text retrieval, 41 were unavailable through legitimate open-access channels and were classified as not retrievable. The accessible publications underwent further eligibility assessment, with reasons documented for subsequent exclusions.

Data collection and evidence synthesis

Information was compiled in a standardized extraction form covering authorship, publication year, geographical setting, study design, participant characteristics, sample size, educational intervention, comparator, evaluated outcomes, and principal findings. Effect estimates, confidence intervals, and statistical significance values were retained whenever reported.

Published abstracts and accessible full-text articles constituted the data sources. When discrepancies occurred between these sections, the full-text account took precedence. Missing information was neither estimated nor imputed, and favorable outcomes were recorded only when explicitly supported by the publication.

Assessment methods varied across the included investigations. Foot care knowledge was predominantly evaluated through study-specific questionnaires, although instruments such as

the Modified Diabetic Foot Care Knowledge questionnaire were also employed. Behavioral outcomes were assessed using the Modification of Diabetic Foot Care Behavior questionnaire, the Nottingham Assessment of Functional Foot Care, and the Diabetic Foot Self-Care Questionnaire of the University of Malaga.

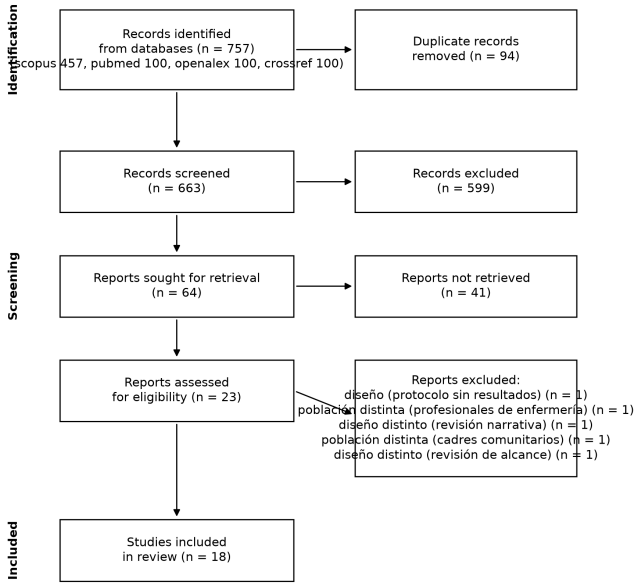
Given the differences in measurement instruments and scoring systems, quantitative pooling was not performed. Findings were instead synthesized using the estimates reported by individual studies, considering the direction of observed changes and their statistical significance.

RESULTS

Study selection

The searches identified 757 records, of which 94 were duplicates, leaving 663 records for title and abstract screening (Figure 1). After screening, 599 records were excluded and 64 reports were sought for full text retrieval. Full text could not be obtained for 41 reports because no legitimate open access copy was available, and these were excluded as not retrievable. The remaining 23 full texts were assessed for eligibility, 5 were excluded with reasons (Table 1), and 18 studies were included in the synthesis.

Figure 1. PRISMA 2020 flow diagram of study selection.



Note: Records were screened by title and abstract and then by full text. Full texts were retrieved only from legitimate open access sources. Source: Prepared by the authors.

Table 1. Studies excluded at full text assessment with reasons.

Study	Reason for exclusion
Multi-theory model foot care education program, 2026	Protocol without results
Diabetic foot care course, e-learning versus workshop, 2021	Population restricted to nurses
Foot care education narrative review, 2026	Narrative review, not an original study
Education and assessment of foot health status, 2024	Population restricted to community health cadres
Diabetic foot care education scoping review, 2026	Scoping review, not an original study

Note: Five reports passed title and abstract screening but were excluded after full text assessment. Source: Prepared by the authors.

Characteristics of the included studies

The 18 included studies enrolled 1,531 participants across 7 countries, with fourteen of eighteen conducted in South or Southeast Asia and sub-Saharan Africa (Table 2). Five studies were randomized controlled trials,(17-21)twelve were quasi-experimental or pre-post studies,(22-33)and one was a prospective observational cohort.(34)The interventions ranged from face-to-face group or individual teaching to pictorial infographics, audio-visual materials, mobile applications, flipped classroom formats, and motivational interviewing. Sample sizes varied from 9 to 336 participants, and most studies measured knowledge or self-care behavior rather than ulcer incidence.

Table 2. Characteristics of the included studies.

Study (author, year, country)	Design	Participants (n)	Intervention versus comparator	Main finding
Joeliantina et al., 2026, Indonesia (22)	QE with control	80	Comprehensive foot self-care module versus lectures	Post-test knowledge 89.68 versus 77.80 (p = 0.0001)
2026, Pakistan (23)	QE pre-post	200	Face-to-face education plus WhatsApp reminders	Knowledge 8.3 to 11.2 and practice 43.3 to 62.4 (p < 0.001)
Sharif et al., 2025, Pakistan (17)	Single-blinded RCT	180	Pictorial infographic education versus routine care	Significant group, time and interaction effects (p < 0.0001)
Suyanto et al., 2025, Indonesia (24)	QE with control	68	Flipped classroom versus face-to-face education	Behavior 42.2 to 46.4 versus 44.2 in control (p = 0.0001)
2019, United States (25)	Pilot pre-post	9	Verbal and visual foot care education	Satisfaction 4.56 (SD 0.53) of five
Suglo et al., 2024, Ghana (18)	Feasibility RCT	50 dyads	Family-oriented foot care intervention versus usual care	Signals favoring intervention on behavior and knowledge
Raju et al., 2024, India (26)	QE pre-post	60	Leaflet versus audio-visual video	Knowledge 45.5 to 69.3 (leaflet) and 46.0 to 84.3 (video)
Sari et al., 2026, Indonesia (27)	QE one-group	107	Health education for ulcer prevention	Improvement in knowledge, self-efficacy and practices (p < 0.05)
2026, Indonesia (28)	QE one-group	15	Foot care education plus motivational interviewing	Knowledge improved; adherence and ulcer risk unchanged
Yokota et al., 2019, Japan (19)	RCT	55	Monthly self-foot-care program versus leaflet	Greater improvement in dryness and horny tissue (p < 0.001)
Mudavath et al., 2021, India (20)	RCT (interim)	125	Participant-driven group education versus standard information	New ulcer in 44.7% with no between-group difference
Okpe et al., 2019, Nigeria (34)	Observational cohort	336	Prior foot care education versus none	Lower amputation (p = 0.002) and infection (p = 0.003)
2023, Indonesia (29)	QE one-group	55	Diabetes self-management education	Significant effect on foot injury prevention
2026, Indonesia (30)	QE one-group	30	Audio-visual foot care education	Knowledge, attitude and action improved (p = 0.000)
2024, Indonesia (31)	QE pre-post	15	Diabetic self foot care education	Knowledge and attitude improved (p = 0.001)
2026, Indonesia (32)	QE with control	36	SAFE-FOOT audiovisual application versus conventional education	No significant between-group difference at post-test (p = 0.650)
Bagban et al., 2026, India (21)	RCT	60	Pharmacist-led education in both arms	Self-care 13.1 to 25.9 within groups (p < 0.001)
2019, India (33)	QE pre-post	50	Video-assisted behavioral change communication	Adequate knowledge 0% to 70%

Note: RCT = randomized controlled trial; QE = quasi-experimental; SD = standard deviation; n = number of participants analyzed or enrolled as reported by each study. Source: Prepared by the authors from the included studies.

The settings reflect the epidemiology of the condition. Eight studies were conducted in Indonesia, four in India, two in Pakistan, and one each in Japan, the United States, Ghana and Nigeria. The populations enrolled were generally adults with type 2 diabetes, with two exceptions: one feasibility trial enrolled adult patient-caregiver dyads at risk of ulceration in Ghana,(18)and one cohort enrolled patients admitted with an established foot ulcer in Nigeria.(34)The theoretical basis of the interventions was heterogeneous. Some programs were grounded in a named behavior

change model, such as the multi-theory model, the transtheoretical model or self-efficacy theory, whereas others used pragmatic educational formats without an explicit theoretical framework.

The delivery formats fell into three broad groups. Face-to-face programs, the most common, included a comprehensive module delivered through lectures plus mentoring in Indonesia,(22) a five-minute session reinforced by written material and WhatsApp reminders in Pakistan,(23)a monthly self-foot-care program in Japan,(19)and participant-driven group education in India.(20) A second group used print or audio-visual media, including pictorial infographics,(17)patient information leaflets and educational videos,(26)audio-visual foot care education,(30)and video-assisted behavioral change communication.(33)A third, smaller group used mobile or blended formats, such as the flipped classroom,(24)a self-care audiovisual mobile application,(32)and a family-oriented intervention tested in a feasibility trial.(18)The outcome instruments were equally varied and included the Modification of Diabetic Foot Care Behavior questionnaire, the Nottingham Assessment of Functional Foot Care, the Diabetic Foot Self-Care Questionnaire of the University of Malaga, and several study-specific questionnaires, which prevented direct pooling of effect sizes.

The comparators showed a similar spread. Twelve of the eighteen studies had no active comparison and relied on before and after change, which is the weakest design for attributing improvement to education. The remaining studies compared education against usual care or a lower intensity alternative, such as a single leaflet,(19)routine information,(17,20) face-to-face teaching,(24) lectures alone,(22)or conventional education.(32)One trial randomized the topical therapy while delivering the same education to both arms, so its contribution is limited to the pre-post change in self-care rather than to the randomized comparison.(21)This distribution of comparators means that most of the quantitative estimates in the literature describe change over time rather than the additional benefit of education over an alternative, a distinction that should be kept in mind when interpreting the reported effect sizes.

Risk of bias

Risk of bias was high or of some concern in every included study, and no study was rated at low risk overall (Table 3).

Table 3. Risk of bias of the included studies.

Study	Design	Tool	Overall judgment	Main concern
Joeliantina et al., 2026(22)	QE with control	ROBINS-I	High	Non-randomized allocation
2026, Pakistan (23)	QE pre-post	ROBINS-I	High	No comparison group
Sharif et al., 2025(17)	RCT	RoB 2	Some concerns	Single-blinded
Suyanto et al., 2025(24)	QE with control	ROBINS-I	High	Non-randomized allocation
2019, United States (25)	Pilot pre-post	ROBINS-I	High	Very small sample, no control
Suglo et al., 2024(18)	Feasibility RCT	RoB 2	Some concerns	Feasibility design
Raju et al., 2024(26)	QE pre-post	ROBINS-I	High	No comparison group
Sari et al., 2026(27)	QE one-group	ROBINS-I	High	No comparison group
2026, Indonesia (28)	QE one-group	ROBINS-I	High	Small sample, no control
Yokota et al., 2019(19)	RCT	RoB 2	Some concerns	Small single-center trial
Mudavath et al., 2021(20)	RCT	RoB 2	Some concerns	Interim analysis
Okpe et al., 2019(34)	Cohort	NOS	Moderate	Residual confounding
2023, Indonesia (29)	QE one-group	ROBINS-I	High	No comparison group
2026, Indonesia (30)	QE one-group	ROBINS-I	High	No comparison group
2024, Indonesia (31)	QE pre-post	ROBINS-I	High	Small sample, no control
2026, Indonesia (32)	QE with control	ROBINS-I	High	Non-equivalent groups
Bagban et al., 2026(21)	RCT	RoB 2	Some concerns	Education not the randomized factor
2019, India (33)	QE pre-post	ROBINS-I	High	No comparison group

Note: RoB 2 = revised Cochrane risk of bias tool for randomized trials; ROBINS-I = risk of bias in non-randomized studies of interventions; NOS = Newcastle-Ottawa Scale. Source: Prepared by the authors.

Among the five randomized trials, four were judged at some concerns because of absence of blinding, because they were feasibility or interim analyses, or because the educational component was not the randomized factor, and one trial was limited by its small single-center size.(17-21) The twelve quasi-experimental and pre-post studies were all rated at high risk of bias because they lacked randomization and, in most cases, lacked any comparison group, which leaves their within-group changes vulnerable to regression to the mean and to secular improvement. The single observational cohort was rated as moderate on the Newcastle-Ottawa Scale because it adjusted for measured confounders in a regression model but could not exclude residual confounding by health literacy or access to care.(34)

The pattern of judgments was driven by design rather than by reporting quality. In the randomized trials, the main recurring concerns were the impossibility of blinding participants to an educational assignment and the self-reported nature of the outcome measures, both of which affect the measurement domain. In the quasi-experimental studies, the absence of a control group in ten of the twelve studies was the dominant issue, because within-group improvement cannot be separated from regression to the mean, from secular trends in foot care awareness, or from the natural history of diabetes self-management. The two quasi-experimental studies that did include a comparison group still lacked random allocation, so baseline differences between groups could explain part of the observed effect. No study was excluded on the basis of its risk of bias rating, and the ratings were used instead to weight the interpretation of the findings.

Effects on foot self-care knowledge and behavior

Foot care knowledge improved in every study that measured it, and the change was statistically significant in all but one comparison (Table 4). The largest absolute gain was reported for audio-visual education, which raised the mean knowledge score from 46.0 (SD 15.2) to 84.3 (SD 9.1) among people with foot ulcers in India.(26)A face-to-face program with written material and WhatsApp reminders increased the proportion of participants with adequate knowledge from 26.5% to 76% and the proportion with adequate practice from 21.5% to 78% in 200 adults with type 2 diabetes in Pakistan.(23)A comprehensive foot self-care module delivered by lectures plus mentoring produced a higher post-test knowledge score than lectures alone, 89.68 versus 77.80 ($p = 0.0001$), in an Indonesian quasi-experimental study.(22)The randomized trials reported effects of similar direction: a pictorial infographic intervention produced significant group and time effects on knowledge and practice scores in a single-blinded trial,(17)and pharmacist-led structured education raised the physical self-care subscale of the Diabetic Foot Self-Care Questionnaire from 13.1 (SD 1.7) to 25.9 (SD 1.4) within groups ($p < 0.001$).(21)When the interpretation was restricted to the five randomized trials, the direction of the effect on knowledge and self-care behavior remained unchanged, although the magnitudes could not be pooled.

Self-care behavior and self-efficacy followed the same pattern. A flipped classroom raised diabetic wound prevention behavior from 42.2 (SD 5.1) to 46.4 (SD 5.5), and the post-test score exceeded the control group value of 44.2 ($p = 0.0001$).(24)A self-foot-care educational program delivered monthly improved foot skin condition, including dryness and horny tissue, relative to a single leaflet in a randomized comparison from Japan.(19)

Table 4. Direction of effects by outcome domain.

Outcome domain	Studies	Direction of effect	Illustrative estimate
Foot care knowledge	16	Improvement	Knowledge 8.3 to 11.2 ($p < 0.001$)(23)
Foot self-care behavior	14	Improvement	Behavior 42.2 to 46.4 ($p = 0.0001$)(24)
Self-efficacy	5	Improvement	Significant within-group change ($p < 0.05$) (27)
Foot skin condition	1	Improvement	Dryness and horny tissue $p < 0.001$(19)
Ulcer incidence or recurrence	2	No clear reduction	New ulcer 44.7% with no between-group difference (20)
Amputation or infection	1	Lower with education	Amputation $p = 0.002$, infection $p = 0.003$(34)

Note: Studies could contribute to more than one domain. Direction refers to the change reported by each study. Source: Prepared by the authors from the included studies.

A one-group health education intervention in Indonesia reported significant improvements in knowledge, self-efficacy, foot care practices and perceived social support ($p < 0.05$),(27)and a diabetes self-management education program reported a significant effect on the prevention of foot injuries.(29)Two studies reported null or partial findings. Motivational interviewing combined with foot care education improved knowledge but not adherence or ulcer risk in a small sample of 15 participants,(28)and a mobile audiovisual application improved the intervention group but did not differ from conventional education at post-test ($p = 0.650$).(32)These two exceptions indicate that gains in knowledge do not translate automatically into behavior or clinical risk. The remaining studies reinforced the same pattern with smaller or less standardized estimates. Audio-visual education improved knowledge, attitudes and actions in a pre-experimental sample of 30 patients, with a normalized gain of 0.762,(30)and video-assisted behavioral change communication raised the proportion with adequate knowledge from 0% before to 70% after teaching in 50 participants.(33)Diabetic self foot care education improved knowledge and attitudes in a small sample of 15 patients with ulcers, with a Wilcoxon statistic significant at $p = 0.001$.(31) The feasibility trial in Ghana, the only study to enroll family dyads, reported efficacy signals favoring the intervention on foot care behavior, self-efficacy and knowledge at twelve weeks, while meeting its recruitment and retention criteria.(18)The pilot study in the United States, with nine patients, reported a satisfaction score of 4.56 (SD 0.53) of five but was too small to estimate effects on knowledge retention.(25)Collectively these studies support the direction of the behavioral findings, although their small samples and absent comparison groups mean they carry less evidential weight than the randomized trials.

Effects on ulcer incidence and ulcer-related outcomes

Direct evidence on ulcer incidence was scarce. Only one randomized trial measured new ulceration, and it found no difference between participant-driven group education and standard information at a six-month interim analysis, when 44.7% of participants had developed a new ulcer.(20)That trial enrolled 125 adults with diabetes and a healed foot ulcer, a population at the highest risk of recurrence, and the authors attributed the null result to external risk factors, such as plantar stress and external trauma, that education does not remove. The single observational cohort provided the only comparative evidence on hard endpoints: among 336 patients admitted with diabetic foot ulcers in Nigeria, prior foot care education was associated with a markedly higher odds of seeking hospital treatment at the onset of injury (odds ratio 5.76, $p < 0.001$) and with lower rates of lower extremity amputation ($p = 0.002$) and wound infection ($p = 0.003$), while mortality did not differ ($p = 0.445$).(34)Only a quarter of that cohort had received prior foot care education, which reflects the gap between guideline recommendations and delivery. These estimates remained directionally consistent when the cohort was considered separately from the interventional studies, but the observational design limited causal interpretation, and the association between education and better outcomes could reflect unmeasured differences in health literacy and access.

Sensitivity analyses

Across the scenarios examined, the main findings kept their sign. When the twelve quasi-experimental studies were excluded and only the five randomized trials were considered, the improvement in knowledge and self-care behavior remained consistent, and the absence of a demonstrated reduction in ulcer incidence was unchanged. With the alternative specification that retained the single observational cohort as a separate source of secondary evidence, the ulcer-related findings remained limited to that one study. The results therefore attenuated, but did not reverse, any claim that education reduces ulcer incidence, and the claim that education improves self-care remained stable under both specifications. A third exploratory specification that separated the two studies with a comparison group from the ten single-arm studies produced the same conclusion, since the comparative studies and the single-arm studies agreed on the direction of the behavioral change. No specification reversed the central pattern.

DISCUSSION

The main finding of this review is that structured foot care education consistently improves foot care knowledge, self-efficacy and self-care behavior in people with diabetes, whereas evidence that it reduces the incidence of diabetic foot ulcers remains scarce and inconclusive. This pattern was maintained when the analysis was restricted to the five randomized trials, which indicates that the behavioral findings do not depend on the uncontrolled designs that dominate the literature,

and it was unchanged when the single observational cohort was considered separately.

The improvement in knowledge and self-care behavior is consistent with earlier syntheses. A systematic review and meta-analysis of foot care education reported pooled improvements in knowledge, self-efficacy and behavior,(10)and an umbrella review reached the same conclusion across educational formats.(12)A systematic review restricted to the impact of education on self-efficacy and self-care likewise documented favorable changes,(9)and a synthesis of health education programs found consistent gains in self-care practices.(35)The present review adds studies published after those syntheses, including digital and community-based interventions, and confirms that the behavioral effect generalizes across low and middle income settings.(11,13) A scoping review of education programs to prevent diabetic foot ulcers likewise catalogued print, digital and blended formats and noted that few studies progressed to ulcer endpoints,(11)which matches the pattern observed here. The agreement across independent syntheses using different search windows and inclusion rules strengthens confidence in the behavioral conclusion, even though the underlying primary studies are individually weak. It also means that the behavioral question is substantially answered and that the unresolved question is not whether education changes what patients know and do, but whether those changes are sufficient to alter the clinical course of the foot. The consistency of the direction across randomized and non-randomized designs is notable for a field in which publication bias toward positive within-group change is plausible, although the high risk of bias in the uncontrolled studies means the magnitude of the behavioral gain is probably overstated.

The behavioral pathway that links education to ulcer prevention is longer than the guideline recommendations imply, and this may explain the divergence between the behavioral and the ulcer findings. Education is designed to raise knowledge, and knowledge is expected to raise self-efficacy, which in turn is expected to sustain daily self-care behaviors. The present review shows that the first two steps of this chain are reliably achieved: knowledge and self-efficacy improved in every study that measured them. The later steps are weaker. Self-care behavior improved in fourteen studies, and the two partial or null results show that knowledge can rise without a corresponding change in adherence and without exceeding an alternative educational format.(28,32) The final step, a reduction in ulceration, additionally requires that the person detect a pre-ulcerative sign and act on it before tissue breakdown, a requirement that education alone may not satisfy. Monitoring interventions that provide an objective feedback signal, such as home skin temperature measurement, convert education into a timed action and have shown effects on ulcer recurrence that education alone has not replicated.(36)This distinction between teaching and feedback is the most plausible explanation for the null ulcer result and should guide how educational programs are designed. If the active ingredient for ulcer prevention is the prompt to act on an early change rather than the knowledge itself, then programs that end at instruction will predictably improve questionnaires without reducing ulcers, while programs that attach education to a scheduled check or a monitoring device will have a better chance of reaching the clinical endpoint. The evidence assembled here supports that reading, although the comparison has not yet been tested head to head in a single trial.

The null finding for ulcer incidence diverges from the assumptions embedded in clinical guidelines. The single randomized trial included here found no reduction in new ulceration with group education,(20)a result that echoes the Cochrane review, which could not demonstrate a reduction in ulceration from education alone.(7)A randomized trial conducted before this review window similarly reported no reduction in ulcer recurrence with a foot care education intervention among people at high risk.(37)By contrast, self-monitoring interventions that pair education with an objective feedback signal, such as home skin temperature monitoring, reduced ulcer recurrence in a landmark trial,(36)which suggests that education alone may be insufficient without a monitoring component that converts knowledge into a timed action. The observational cohort in this review associated prior education with lower amputation and infection,(34)a finding that is directionally supportive but vulnerable to confounding, because people who receive education may also differ in health literacy, socioeconomic position and access to care. The successive guideline updates have nonetheless continued to place education at the center of prevention, moving from a general recommendation in the 2019 guidance to a more explicit integration of education with risk stratification in the 2023 update.(5,6) The present review does not contradict that placement, but it clarifies that the guideline rests on behavioral evidence rather than on demonstrated reductions in ulcer incidence, and that the recommendation is best understood as a component of a package rather than a stand-alone intervention.

The heterogeneity of the included studies has identifiable sources. Designs ranged from single-arm pre-post studies to randomized trials, and the risk of bias was high in the majority.

Outcome instruments varied from the Modified Diabetic Foot Care Behavior questionnaire to study-specific scales, which prevented pooling. The interventions also differed in dose, format and theoretical basis, from single five-minute sessions to monthly programs sustained over several months, and this variation was rarely described in enough detail to identify the active component. The overrepresentation of studies from Indonesia, India and Pakistan limits direct transferability to other health systems, although the consistency of the behavioral effect across those settings is itself informative. Knowledge and attitude surveys in India and China show that large gaps between knowledge and practice persist even after education,(38,39) and frailty has been associated with lower foot self-efficacy in older adults,(40)which may explain why several interventions improved knowledge without changing behavior or clinical risk. The high recurrence rates documented within the first year of ulcer remission show why behavioral maintenance, and not only initial knowledge gain, is the relevant target.(41)

The generalizability of these findings deserves a separate comment. The concentration of studies in Indonesia, India, Pakistan and sub-Saharan Africa means the behavioral effect is best documented in settings where structured podiatry is scarce and where community-based or digital delivery may be the only scalable option.(13)In those settings, the observed gains are encouraging because they were achieved with low-cost formats such as infographics, leaflets and short face-to-face sessions. At the same time, the evidence cannot be transferred mechanically to high-income systems with different care pathways, where the marginal contribution of education may be smaller because risk stratification and professional foot care are already embedded. The absence of dose-response information is a further barrier: no included study compared different intensities of education directly, so the minimum effective dose remains unknown, and the two studies that delivered the most intensive formats, monthly education(19)and family-oriented education,(18)were also among the most favorable, which hints at a dose gradient that future trials should test explicitly.

The strengths and limitations of this review should be read together. The main strengths are the explicit PRISMA 2020 methods, the use of four databases with Scopus as the primary source, a reproducible search string, and a risk of bias assessment that separates randomized from non-randomized evidence. The main limitations follow from the evidence itself. First, most studies were uncontrolled before and after designs at high risk of bias, which weakens causal inference; the recommendation is to prioritize randomized designs with objective endpoints. Second, only two studies measured ulcer incidence, and full text was unavailable for 41 otherwise eligible records because they were not open access; the recommendation is to register the review and to seek author-provided full texts in an update. Third, screening was performed by one reviewer assisted by artificial intelligence rather than two independent reviewers, which may have introduced single-reviewer error; the recommendation is to replicate the selection with a second reviewer. Fourth, the absence of a meta-analysis prevented pooled estimation, and certainty was therefore not formally graded; the recommendation is to standardize outcome instruments and report effect sizes so that quantitative synthesis becomes possible. Fifth, the restriction to publications in English and Spanish may have excluded relevant studies published in Indonesian, Arabic or Chinese, languages in which several of the source journals operate; the recommendation is to relax the language restriction in a future update. Sixth, the bibliographic window of 2018 to 2026 excluded earlier landmark trials, which were consulted only as contextual support rather than as included evidence; the recommendation is to weigh whether an unrestricted window would materially change the ulcer conclusion. None of these limitations changes the central observation that the behavioral evidence is consistent while the ulcer evidence is thin.

The implications for practice follow directly from this pattern. Clinicians and educators can expect foot care education to improve knowledge and self-care behavior, and the low-cost formats identified here, such as infographics, leaflets, short face-to-face sessions and audio-visual materials, are feasible to deliver in primary care and community settings. Clinicians should not, however, assume that education alone prevents ulcers, particularly in people at high risk, for whom education should be combined with risk stratification and structured monitoring of the foot according to the current guideline framework.(5)Health systems that rely on community health workers or mobile delivery should treat education as the entry point of a prevention pathway rather than its endpoint, and they should link it to a mechanism for detecting and responding to early foot changes.(42)For research, trials should report ulcer incidence and time to ulcer as primary outcomes, use validated instruments with published scoring, describe the theoretical basis and dose of the intervention so that effective components can be isolated, and pre-register their protocols to reduce selective reporting. Comparative designs that vary the intensity or the addition of a monitoring component would directly address the dose and feedback questions that this review could not resolve.(41)

CONCLUSIONS

Structured foot care education improves foot care knowledge and self-care behavior in people with diabetes, with a consistent effect across randomized and non-randomized studies. The evidence that education reduces the incidence of diabetic foot ulcers remains limited to one null randomized trial and one observational cohort, and is of low certainty. This pattern was stable across all sensitivity analyses performed. Education should therefore be delivered as one component of a broader prevention strategy that includes risk assessment and structured monitoring, and future trials should measure ulcer incidence directly as the primary outcome.

REFERENCES

1. Armstrong DG, Boulton AJM, Bus SA. Diabetic Foot Ulcers and Their Recurrence. N Engl J Med. 2017;376(24):2367-2375. doi: 10.1056/nejmra1615439
2. Zhang P, Lu J, Jing Y, Tang S, Zhu D, Bi Y. Global epidemiology of diabetic foot ulceration: a systematic review and meta-analysis. Annals of Medicine. 2017;49(2):106-116. doi: 10.1080/07853890.2016.1231932
3. Alberts KN, Companie MN, Kerrod MP, Davies J, Bock RDE, Swart C, et al. Lower Limb Amputations Among Individuals Living With Diabetes Mellitus in Low- and Middle-Income Countries: A Systematic Review and Meta-Analysis. World j surg. 2026;50(9):2750-2759. doi: 10.1002/wjs.70493
4. Olamoyegun MA, Afolabi SA, Alare K, Olamoyegun OD, Adeyemi T, Olopade OB. Epidemiology and Outcome of Diabetic Foot Ulcers in Nigeria: A Systematic Review and meta-analysis of 2 Decades: 2005 – 2024. J Epidemiol Glob Health. 2026;16(1):19. doi: 10.1007/s44197-025-00509-4
5. Bus SA, Sacco ICN, Monteiro-Soares M, Raspovic A, Paton J, Rasmussen A, et al. Guidelines on the prevention of foot ulcers in persons with diabetes (IWGDF 2023 update). Diabetes Metabolism Res. 2024;40(3):e3651. doi: 10.1002/dmrr.3651
6. Bus SA, Lavery LA, Monteiro-Soares M, Rasmussen A, Raspovic A, Sacco ICN, et al. Guidelines on the prevention of foot ulcers in persons with diabetes (IWGDF 2019 update). Diabetes Metabolism Res. 2020;36(S1):e3269. doi: 10.1002/dmrr.3269
7. Dorresteijn JA, Kriegsman DM, Assendelft WJ, Valk GD. Patient education for preventing diabetic foot ulceration. Cochrane Database of Systematic Reviews. 2014;2014(12). doi: 10.1002/14651858.cd001488.pub5
8. Adiewere P, Gillis RB, Imran Jiwani S, Meal A, Shaw I, Adams GG. A systematic review and meta-analysis of patient education in preventing and reducing the incidence or recurrence of adult diabetes foot ulcers (DFU). Heliyon. 2018;4(5):e00614. doi: 10.1016/j.heliyon.2018.e00614
9. Goodall RJ, Ellauzi J, Tan MKH, Onida S, Davies AH, Shalhoub J. 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. 2020;60(2):282-292. doi: 10.1016/j.ejvs.2020.03.053
10. Yıldırım Ayaz E, Dincer B, Oğuz A. The Effect of Foot Care Education for Patients with Diabetes on Knowledge, Self-Efficacy and Behavior: Systematic Review and Meta-Analysis. The International Journal of Lower Extremity Wounds. 2022;21(3):234-253. doi: 10.1177/15347346221109047
11. Sulistyo AAH, Sari JDE, Efendi F, Nurmala I, Dhamanti I, Suhamdani H. Education program to prevent diabetic foot ulcer in patient with diabetes: A scoping review. AJRH. 2024;28(10s):397-410. doi: 10.29063/ajrh2024/v28i10s.42
12. Alshammari L, O'Halloran P, McSorley O, Doherty J, Noble H. The effectiveness of foot care educational interventions for people living with diabetes mellitus: An umbrella review. Journal of Tissue Viability. 2023;32(3):406-416. doi: 10.1016/j.jtv.2023.06.001
13. Wang C, Zhang Q, Wang Y, Li X, Yang Y, Nie S, et al. Digital Health and Community-Based Care for Diabetic Foot Prevention and Management in Resource-Limited Settings: A Narrative Review. JMDH. 2026;Volume 19:1-16. doi: 10.2147/jmdh.s620320
14. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021:n71. doi: 10.1136/bmj.n71
15. Sterne JAC, Savović J, Page MJ, Elbers RG, Blencowe NS, Boutron I, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ. 2019:l4898. doi: 10.1136/bmj.l4898
16. Sterne JA, Hernán MA, Reeves BC, Savović J, Berkman ND, Viswanathan M, et al. ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. BMJ. 2016:i4919. doi: 10.1136/bmj.i4919
17. Sharif H, Kadir M, Hashmi M, Naz S, Azam I, Imam A, et al. Effectiveness of pictorial educational intervention on foot care among individuals having type 2 diabetes at slums of Karachi, Pakistan: asingle blinded randomized control trial. BMC Public Health. 2025;25(1):3214. doi: 10.1186/s12889-025-23969-6
18. Suglo JN, Winkley K, Sturt J. Improving foot self-care in people with diabetes in Ghana: A development and feasibility randomised trial of a context appropriate, family-orientated diabetic footcare intervention. PLoS ONE. 2024;19(5):e0302385. doi: 10.1371/journal.pone.0302385
19. Yokota K, Hayashi Y, Kurata J, Fujita A. Effectiveness of a Self-Foot-Care Educational Program for Prevention of Diabetic Foot Disease. Health. 2019;11(01):9-19. doi: 10.4236/health.2019.111002
20. Mudavath S, Bollepaka KK, Sudhakar Y. Patient education for the prevention of diabetic foot ulcers: Government Medical College, Suryapet [Internet]. International Journal of Health and Clinical Research; 2021 [cited 2026 Oct 28]. Available from: https://www.ijhcr.com/index.php/ijhcr/article/view/2324
21. Bagban AA, Wali SC, Kajagar BM. Impact of Clinical Pharmacist-Led Structured Education on Diabetic Foot Self-Care Behaviors in Patients with Diabetic Foot Ulcers: A Randomized Controlled Trial. IJDDT. 2026;16(61s). doi: 10.25258/ijddt.16.61s.161
22. Joeliantina A. Comprehensive Intervention Module to Improve Foot Self- Care Knowledge in Patients with Diabetes Mellitus. Gac Méd Caracas. 2026;134(1):146-154. doi: 10.47307/gmc.2026.134.1.12
23. Asghar F, Saeed R, Sarfaraz A, Durrani N. Effectiveness of Educational Intervention to Improve Knowledge and Practices regarding Foot Care among Patients with Type 2 Diabetes. LNJPC. 2026;8(2):144-151. doi: 10.37184/lnjpc.2707-3521.8.52
24. Suyanto S, Sukartini T, Efendi F, Noor MA, Wahyuni R. Innovative Foot Care Education Model Utilizing Flipped Classroom Method to Improve Diabetic Wound Prevention Practices. JKS. 2025;20(2):127. doi: 10.20884/1.jks.2025.20.2.14710

25. Green-Morris G. An evaluation of the effectiveness of foot care education in rural clinics. J Diabetes Metab Disord. 2019;18(1):207-215. doi: 10.1007/s40200-019-00407-0
26. Raju BN, Mateti UV, Mohan R, D'Souza C, Shastry CS, D'Souza N. Comparing the efficiency of written and audio-visual aids on imparting knowledge about diabetic foot ulcer to patients. Journal of Applied Pharmaceutical Science. 2024;14(2):255-260. doi: 10.7324/japs.2024.147324
27. Rita Sari, Purwono J. A Health Education Intervention to Improve Diabetic Foot Ulcer Prevention: Effects on Knowledge, Self-Efficacy, Social Support, and Foot Care Practices. JHealthEdu. 2026;11(1):69-79. doi: 10.15294/jhealthedu.v11i1.40405
28. Vitniawati V, Suprapti T. Combined Foot Care and Motivational Interviewing in Preventing Diabetic Foot Ulcers. KEPO. 2026;7(1):160-169. doi: 10.36590/kepo.v7i1.1858
29. Fitria N, Rizana N, Andala S, Mursal, Afifah D. Effect of Diabetes Self-Management Education on the Prevention of Diabetic Foot Injuries. IJRIAS. 2023;VIII(II):96-100. doi: 10.51584/ijrias.2023.8203
30. Manurung RD, Ginting SB, Aprian V. Effectiveness of audiovisual foot care-based education on improving knowledge, attitudes and actions of diabetic patients in preventing foot ulcer diabetic [Internet]. Proceeding International Conference On Health Science; 2026 [cited 2026 Oct 28]. Available from: https://ojs.poltekkes-medan.ac.id/icohs/article/view/2597
31. Jamaluddin A, Wahdaniah W. DSFC Education on Knowledge And Attitude To Prevent Diabetic Foot Ulcer. JNJ. 2024;6(1):1-17. doi: 10.37311/jnj.v6i1.23393
32. Ernawati E, Ariyanti M, Istianah I. Pengembangan Aplikasi Self-Care Audiovisual Footcare Education (SAFE-FOOT) terhadap Peningkatan Perawatan Kaki Dalam Mencegah Diabetic Foot Ulcer. khatulistiwa nurs j. 2026;8(1):33-46. doi: 10.53399/knj.v8i1.376
33. G V, Bhuvaneshwari G, . P, K. R P, P P, . R. Effectiveness of Behavioural Change Communication on Knowledge of Self Care Management of Diabetic Foot Ulcer among Diabetes Patients. SJNHC. 2019;02(09):317-320. doi: 10.36348/sjnhc.2019.v02i09.007
34. Innocent O, Ejiofor U, Olufunmilayo A, Ibrahim G, Marcelina E, Ignatius E. Foot Care Education, Health-Seeking Behaviour and Disease Outcome in Patients with Diabetic Foot Ulcer: Results from the Multi-Centre Evaluation of Diabetic Foot Ulcer in Nigeria Study. Int J Foot Ankle. 2019;3(2). doi: 10.23937/2643-3885/1710038
35. Sampson EO, Abdul Manaf R, Ismail S, Shahar HK, Udeani TK. Improving Foot Self-care Practices Through Health Education Intervention Programs Among Diabetic Patients: A Systematic Review. MJMHS. 2023;19(4):315-325. doi: 10.47836/mjmhs.19.4.44
36. Lavery LA, Higgins KR, Lanctot DR, Constantinides GP, Zamorano RG, Athanasiou KA, et al. Preventing Diabetic Foot Ulcer Recurrence in High-Risk Patients. Diabetes Care. 2007;30(1):14-20. doi: 10.2337/dc06-1600
37. Lincoln NB, Radford KA, Game FL, Jeffcoate WJ. Education for secondary prevention of foot ulcers in people with diabetes: a randomised controlled trial. Diabetologia. 2008;51(11):1954-1961. doi: 10.1007/s00125-008-1110-0
38. Naik BNK, Khan MJRA, Prabhath S, Kerr D, Maiya AG, Hutchinson A, et al. Knowledge, attitudes, and practices related to diabetic foot care among individuals with diabetes in India: a systematic review and meta-analysis. BMC Public Health. 2026;26(1):744. doi: 10.1186/s12889-026-26295-7
39. Xiao Y, Liu S, Wang Y, Wang F. Knowledge, attitudes, and practices regarding diabetic foot care among patients with diabetes in China: a systematic review and meta-analysis. Front Public Health. 2026;14:1922404. doi: 10.3389/fpubh.2026.1922404
40. Bilici D, Kılıç M. Impact of frailty on foot care behaviors and self-efficacy in middle-aged and older adults with type 2 diabetes. Primary Care Diabetes. 2026;20(1):115-119. doi: 10.1016/j.pcd.2025.11.009
41. Theodorakopoulos G, Armstrong DG. The First Year of Remission: A Systematic Review and Meta-Analysis of 12-Month Diabetic Foot Ulcer Recurrence. Diabetology. 2026;7(3):61. doi: 10.3390/diabetology7030061
42. Chávez Moya MO, Cabrera LH, Ramírez LM, González González MA, Pazos AA, Fernández Feitó LB, et al. From ulcer to remission: podiatric and technological strategies to prevent ulceration and amputation in the diabetic foot. SAP Podiatry. 2026;3:160. doi: 10.62486/pod2026160

FUNDING

No financing

CONFLICT OF INTEREST

None

AUTHORSHIP CONTRIBUTIONS

Drafting – original draft: Neisy Pérez Ramos, Gabriela González Pernas, Mariam Alejandra González González, Andy Alonso Pazos.
Writing–review and editing: Neisy Pérez Ramos, Gabriela González Pernas, Mariam Alejandra González González, Andy Alonso Pazos.