ORIGINAL ARTICLE

Knowledge and Practices of Diabetic Foot Care: A Cross-sectional Study in A Rural Community

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ABSTRACT

Introduction: Diabetic foot ulcers are among the most significant complications that can arise from diabetes mellitus, a chronic, lifelong disorder. These ulcers present not only a medical problem but also a serious public health threat, particularly in Malaysia's rural areas, where awareness and practice of diabetic foot care are limited. This study aims to assess the current knowledge and practices related to diabetic foot care among individuals with diabetes in the community. **Materials and Methods:** A cross-sectional study was conducted involving 138 individuals with diabetes from the community. Data were collected using a systematic questionnaire using the Nottingham Assessment of Functional Foot Care. The association between demographic characteristics and knowledge and practices of diabetic foot care was analysed using SPSS version 25, employing both descriptive and inferential statistics, including Pearson correlation. **Result:** Findings from the study found that 83.56% of participants exhibited proper foot care practices and 70.36% demonstrated a solid understanding of diabetic foot care. Moreover, a significant positive correlation ($r=0.65$, $p<0.01$) was identified between knowledge and practices, indicating that higher levels of knowledge lead to better foot care practices. **Conclusion:** This correlation underscores the importance of strengthening community-based diabetic education in rural Malaysia, where improved knowledge can directly translate into reduced ulcer incidence and lower amputation rates. By raising awareness and establishing stronger support systems, this approach can reduce the incidence of foot ulcers and their complications, ultimately improving the quality of life for diabetic patients.
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INTRODUCTION

Diabetes mellitus is a long-term metabolic disease marked by elevated blood sugar levels brought on by either insufficient insulin synthesis or insulin resistance. According to the World Health Organisation (WHO) [1], the global prevalence of diabetes has been rising, with over 422 million people diagnosed as of 2014. Recent statistics on global diabetes prevalence reveal alarming trends. As of 2023, approximately 529 million people worldwide are living with diabetes, which constitutes about 6.1% of the global population. This number is projected to increase significantly, potentially reaching 1.3 billion by 2050 [2].

In Malaysia, the National Health and Morbidity Survey 2019 reported that 3.9 million adults aged 18 and above have diabetes, with nearly half of them undiagnosed, putting them at risk of severe complications such as diabetic foot ulcers [3]. Morbidity Survey reported that approximately 3.9 million adults are living with diabetes, with nearly half of them unaware of their condition [4]. As of November 2023, the prevalence of diabetes in Malaysia is reported to be 18.3% among adults aged 18 and above, which translates to approximately 3.9 million individuals diagnosed with the condition [5]. This alarming statistic highlights diabetes mellitus, a chronic metabolic disease, is a major cause of morbidity and mortality worldwide, with complications such as diabetic foot ulcers (DFUs) posing a significant threat to health, particularly in rural communities. Foot ulcers in diabetics can have serious consequences, including amputations and reduced quality of life, often due to poor foot care.

Despite the importance of preventative foot care, studies [6-8] have shown that many people, especially in rural areas, have limited knowledge and poor adherence to foot care guidelines. This is of particular concern in Malaysia, where the prevalence of diabetes is increasing and rural populations often face challenges such as limited access to healthcare services, low health literacy, and inadequate education on diabetes management. Despite multiple education efforts, little is known about how knowledge translates into sustained foot-care practices among rural Malaysian diabetics. Given these concerns, this study aims to assess the levels of knowledge and practises related to diabetic foot care among individuals with diabetes in rural Malaysian community. Using a cross-sectional design, the study examines how well participants understand and practise foot care and explores the relationship between demographic factors and foot care behaviour. Findings from this study are intended to inform targeted educational interventions that cater to the specific needs of rural diabetic populations, thereby enhancing preventive care and reducing DFU incidence.

Millions of individuals worldwide live with diabetes mellitus, a chronic metabolic disease whose incidence is expected to rise sharply over the coming decades, driven by population ageing, urbanisation, sedentary lifestyles, and dietary transitions. In 2021, an estimated 537 million people had diabetes; this figure is projected to increase to 643 million by 2030 and 783 million by 2045 [9]. More recent modelling by Klein [10] suggests that by 2050 as many as 1.3 billion people may be affected globally, with the steepest growth anticipated in low- and middle-income countries. This trajectory underscores the urgent need to strengthen healthcare accessibility particularly screening and early detection, sustained access to essential medicines (e.g., insulin), and patient education for self-management to prevent complications and contain the substantial economic burden associated with diabetes.

Up to 25% of people with diabetes develop diabetic foot ulcers (DFUs) [7, 11]. The pathway is more complex than loss of protective sensation or reduced perfusion alone. Peripheral sensory–motor neuropathy causes intrinsic muscle wasting, foot deformities (e.g., claw/hammer toes, Charcot changes), limited joint mobility, and callus formation changes that elevate plantar pressures and shear during gait. Because protective sensation is diminished, repetitive micro-trauma at these high-pressure sites goes unnoticed, precipitating skin breakdown; concomitant peripheral arterial disease and impaired host defence then delay healing and predispose to persistent or recurrent infection [11, 12, 22]. Given this mechanism, effective foot care must prioritise pressure reduction: regular foot inspections, appropriate footwear, and evidence-based offloading (e.g., total contact casting, removable walkers, customised insoles) directly target elevated plantar pressure and have been shown to reduce ulcer incidence and recurrence [12, 22, 26]. Early medical intervention remains essential to limit complications and prevent progression to amputation [7, 11].

Effective foot care is crucial to prevent the occurrence of foot ulcers and the associated complications. Regular foot inspections, proper hygiene, appropriate footwear, and early medical intervention are essential components of diabetes management [12]. Despite the well-known benefits of these practises, research shows that many people, especially in rural areas, are not adequately informed about diabetic foot care and do not adhere to preventive practises [6-8, 13]. In rural communities, barriers such as limited access to healthcare, low health literacy, and socioeconomic challenges contribute to poor foot care outcomes [14]. Therefore, improving foot care education and providing targeted interventions are critical steps to reduce the incidence of diabetic foot ulcers and improve health outcomes for people with diabetes, especially in underserved populations.

Psychological distress and diabetic care living with diabetes often results in psychological distress, including anxiety, depression, and a sense of hopelessness, which can negatively impact diabetic self-care, including foot care practices [15]. Patients struggling with mental health issues may lack the motivation or energy to consistently perform daily foot checks or follow foot care routines. A study by Srass et al. [16] found that diabetic patients with symptoms of depression were significantly less likely to adhere to recommended foot care practices, highlighting the need for mental health support within diabetes care programs. Zhu et al. [17] noted that in rural communities, lack of regular follow-ups and healthcare support further complicates diabetic foot care, as patients do not receive consistent guidance. These findings collectively point to the need for subsidised healthcare programs and tailored educational resources to address financial and educational barriers, ensuring that diabetic patients have equitable access to necessary foot care resources. Meanwhile disparities in rural Malaysian settings, where a lack of healthcare facilities and educational resources contributes to inadequate foot care practices [18].

Knowledge and practice of diabetic foot care are critical in preventing complications. Studies across various regions have demonstrated that proper education and consistent foot care practices can significantly reduce the incidence of DFUs. A study by Tuglo et al. [19] highlighted that diabetic patient with a good understanding of foot care practices, such as regular self-inspection, proper footwear, and avoiding trauma, had fewer complications. Mandal et al., 2023 [13] observed that lower levels of health literacy are common in rural populations, which correlates with an increased risk of severe foot complications among diabetic patients. This highlights the need for tailored educational programs that simplify health information and make it accessible

to individuals with varying literacy levels. Patients with limited education may not fully understand the importance of daily foot inspections, proper footwear, or routine check-ups.

In the study conducted by Azmi et al. [20] suggested that 59.6% of diabetic patients in Malaysia lack proper foot care knowledge, which correlates with higher rates of foot complications, remain a leading cause of hospitalisation and amputation among diabetic patients, especially in rural areas where healthcare resources may be limited. Similarly, study by Gupta et al. [21] found that diabetic patients with higher foot care knowledge were less likely to experience ulcerations and highlighted that awareness campaigns in rural settings could be highly beneficial in educating diabetic patients about foot care practices.

The study by Swaminathan et al. [22] indicated that the lack of regular follow-ups and healthcare support further complicates the management of diabetic foot conditions. In rural areas, healthcare infrastructure might not be sufficiently robust to offer regular check-ups, leaving patients to manage their conditions without adequate guidance. Addressing these barriers requires a multifaceted approach, involving not only patient education but also systemic improvements in healthcare delivery.Patients with strong support networks whether through family, friends, or community groups are more likely to adhere to diabetic foot care practices [23]. A study by Ghasemi et al. [24] found that patients who participated in support groups or had regular interactions with peers managing diabetes demonstrated higher rates of foot care adherence. These support networks provide encouragement, practical advice, and a sense of accountability, helping patients overcome emotional and psychological barriers.

Education plays a pivotal role in managing diabetic foot care. The correlation between knowledge and practice has been established in multiple studies, such as those by Drovandi et al. [25], who found that patients who received educational interventions from healthcare providers demonstrated significantly improved foot care practices. The study emphasised the importance of a multidisciplinary approach, where nurses, doctors, and diabetes educators work together to provide comprehensive care. A recent meta-analysis by Yıldırım et al. [26] shows that structured diabetic-foot education can reduce ulcer incidence among participants. Complementing this, culturally tailored, community-based programmes in rural settings improve adherence to recommended foot-care practices [27]. Such programmes typically combine workshops, scheduled follow-ups, and the involvement of local healthcare workers so that content remains accessible and context-relevant. In line with this, Oliver and Mutluoglu [28] emphasise engaging local healthcare staff who understand community-specific needs and can navigate cultural and logistical barriers to care. Nevertheless, most evaluations to date have focused on short-term outcomes; sustained behaviour change beyond the intervention period is rarely measured. Thus, while education is effective, future work should embed longer follow-up and behaviour-change frameworks to demonstrate durable impact and inform truly sustainable interventions [26,28].

Moreover, Manickum et al. [29] investigated the effectiveness of foot care educational programs in South African communities and found that participants who received training showed a marked improvement in foot care practices. Sulistyo et al. [30] noted that program-based education significantly reduced DFU incidence among participants by addressing specific barriers in rural healthcare access and traditional beliefs around diabetes management. Educational interventions tailored to rural settings, where healthcare resources are sparse, shown to be effective in reducing DFU incidence and related complications [22, 30]. Meanwhile, Bjurk et al. [31] documented that limited health literacy prevents patients from understanding the importance of preventive foot care.

MATERIALS AND METHODS

Study design and sample selection

This study employed a quantitative research design involving 138 participants from the diabetic community in Bakri Batu 6, Muar, Johor to assess current knowledge and practices related to diabetic foot care among individuals with diabetes in the community. Participants for this cross-sectional study were selected by random sampling with the inclusion criteria required of participants diagnosed with diabetes and willing to participate voluntarily in the survey. The sample size was determined based on Krejcie and Morgan's table [32], ensuring accurate representation and statistical reliability.

Data collection and instrumentation

Data was collected using a structured questionnaire adapted from the Nottingham Assessment of Functional Foot Care, developed by Lincoln et al. [33], to assess participants' understanding and daily practices of foot care. The questionnaire was divided into three sections: [1] demographic information, [2] knowledge of diabetic foot care, and [3] practices of diabetic foot care. The demographic information section gathered five key variables: age, gender, education level, duration of diabetes, and the primary source of foot care knowledge (e.g., internet, healthcare provider, or peers). Knowledge of Diabetic Foot Care section comprised 10 items designed to evaluate participants' understanding of diabetic foot care. Participants' knowledge was assessed using dichotomous "yes" or "no" questions, with each correct answer earning 1 point and each incorrect answer scoring 0. Based on the total score,

knowledge was categorised as “good” (scores of 7-10) or “poor” (scores of 0-6), following the criteria set by Tuglo et al. [19]. The practices of Diabetic Foot Care section included 10 items assessing participants' foot care practices. Similar to the knowledge section, each item was answered with “yes” or “no,” and responses were scored accordingly (1 point for a correct answer, 0 points for an incorrect answer). The scores for each participant were tallied, and practice was categorised as “good” (scores of 7-10) or “poor” (scores of 0-6), based on the total score. A cumulative cutoff score of ≤60% (0-6) was considered indicative of "poor" adherence to recommended foot care practices, while ≥70% (7-10) was classified as "good" practice, as per Tuglo et al. [19].

Data were analysed using SPSS software Version 25. Descriptive statistics were employed to summarise demographic characteristics, level of knowledge, and practices of the participants. The levels of knowledge and practices related to diabetic foot care were categorised into three groups: "good" (score > 70%), "moderate" (50-70%), and "poor" (score < 50%), based on predefined cut-off points. Pearson’s correlation was used for inferential statistics analysis utilised to examine the relationship between knowledge and practice of diabetic foot care levels among the participants. Statistical significance was set at $p < 0.05$ for all analyses.

Ethical clearance

This study was approved by Research Committee, Faculty of Technology and Applied Sciences, Open University Malaysia OUM/RPMU 2.7/379.2/EA976/Sept 2023(019).

RESULTS

Respondents demographic profile

Table I shows the demographic distribution of the 138 respondents and indicates several notable patterns relevant to this study. Most respondents were in the middle and older age categories, with 85.5% aged 41 years and above, reflecting a demographic group typically associated with increased diabetes-related risks. The gender distribution was relatively balanced, though slightly skewed towards males (55%), suggesting comparable representation of both sexes in the analysis. A large proportion of respondents reported limited formal education, where 58.7% had primary education or below. This gives an early indication that health literacy levels may be low, which could influence knowledge and behavioural outcomes measured in this study. Only a small subgroup (13.8%) possessed tertiary education, signalling a statistically small subgroup with potentially stronger health comprehension. Disease duration analysis shows that four out of five respondents (80%) were diagnosed within the past five years. This distribution suggests that most participants were in the early phase of adapting to long-term diabetes self-management. Since duration can influence patient behaviour, this creates an important context for understanding variations in foot care practices. The data also highlight a clear shift in health information-seeking behaviour. Internet-based information was the dominant source (63%), compared with direct professional advice from healthcare providers (30%). This statistic signals a change in patient engagement patterns, whereby digital content may be driving preventive behaviour in rural communities a point later supported by practice outcomes in this study. The absence of book-based learning (0%) further strengthens the significance of accessible digital education channels for this population.

Table I: Demographic profiles of respondents

Characteristics		N	%
Age	21 – 40	20	14.5
	41 – 60	66	47.8
	61 – 80	52	37.7
Gender	Male	76	55
	Female	62	45
Education	Not schooling	43	31.2
	Primary School	38	27.5
	Secondary school	38	27.5
	College/University	19	13.8
Year of Diabetes	< 5	111	80
	> 5 and above	27	20

Level of knowledge among respondents

Table II presents the distribution of knowledge scores among the respondents. The majority, 70.36% (n=97), demonstrated good knowledge of diabetic foot care, while 29.62% (n=41) exhibited poor knowledge. No respondents were classified under the "moderate" knowledge category.

Table II: Distribution of respondent’s knowledge level for diabetic foot care

Knowledge level	Frequency (n)	Percentage (%)
Good knowledge (>70%)	97	70.36%
Moderate (50-70%)	0	0
Poor knowledge (< 50%)	41	29.62%

Level of practices among respondents

Table III shows that the majority of respondents (83.56%, n = 115) demonstrated good practices regarding diabetic foot care, while 16.44% (n = 23) exhibited poor practices. The proportion achieving good practice exceeds the proportion with good knowledge, suggesting that routine cues, provider/family prompts, or community norms may be supporting adherence even where knowledge is incomplete.

Table III: Distribution of respondent’s practice levels for diabetic foot care

Practice	Frequency (n)	Percentage (%)
Good practice (>70%)	115	83.56%
Moderate practice (50-70%)	0	0%
Poor practice (< 50%)	23	16.44%

Correlation between knowledge and practices

Table IV presents a significant positive correlation ($r = 0.65$, $p < 0.01$) between participants' knowledge and practices related to diabetic foot care. The correlation coefficient ($r = 0.65$). This effect size indicates that higher knowledge is strongly associated with better day-to-day foot-care behaviours. While correlation does not imply causation, the magnitude provides a clear, actionable signal: strengthening knowledge is likely to yield meaningful improvements in practice for many individuals.

Table IV: Correlation analysis between knowledge and practices of diabetic foot care

Variables	1	2
Knowledge of Foot Care	1	
Practices of Foot Care	0.65**	1

DISCUSSION

Knowledge of diabetic foot care

This study aims to investigate the knowledge and practice of diabetic foot care among rural communities. The demographic analysis highlights several factors that influence knowledge and practices related to diabetic foot care. The key demographic variables included age, gender, education level, and duration of diabetes. In this study, descriptive analysis from the demographic data shows that 29.62% of the participants are diabetes patients and exhibited poor knowledge of diabetic foot care, was aligned with the study done by Bekele et al. [34] that diabetic patients often face a lack of adequate knowledge regarding the importance of daily foot care, leading to delayed detection of complication and a higher risk of ulceration. This study also identified that 63% of the respondents gained their knowledge from internet resources, none from books. Meanwhile, 30 % get information from healthcare providers and 7% get information and knowledge about diabetic foot care from their friends. The findings highlight the need for tailored educational programs that address specific needs of different communities. These results are aligned with those of Jongebloed et al. [35], who observed that rural populations increasingly rely on digital sources for health information due to limited healthcare resources. These results highlight that while knowledge is fairly high, accessibility and literacy still moderate its application. This mirrors findings from rural Ghana [19] and Penang [18], suggesting structural rather than informational barriers. However, the reliance on online information may present challenges, as the quality of such resource can vary and may not always be relevant to the unique healthcare contexts of rural areas. This trend suggests a gap in accessible, reliable educational resources specifically focussed on diabetic foot care in rural areas, reinforcing the need for structured, locally adapted educational interventions. In addition, Goodall et al. [36] found that patients who received education from healthcare providers showed greater improvements in foot care practices, reinforcing the importance of professional guidance in fostering effective self-care habits.

The demographic data analysis from this study provides a clear understanding of the population's health behaviours and identifies key areas where interventions could be targeted to improve outcomes, particularly in rural settings where access to healthcare and education may be limited. Addressing these demographic disparities requires targeted educational interventions that consider the specific needs and limitations of each group, including economic support programs that can help reduce the financial burden associated with diabetic foot care. By understanding these demographic factors, healthcare providers can develop more effective and inclusive strategies to promote better foot care practices among diabetic patients. Interventions to address Cultural and Psychological Barriers Addressing cultural and psychological barriers requires healthcare interventions that are sensitive to patients' social and cultural backgrounds. Additionally, integrating mental health support into diabetic care can improve adherence to foot care practices. For example, telemedicine services that provide mental health counselling alongside diabetes education have been shown to increase patient engagement and adherence to foot care routines [37].

Diabetic foot care practice

The descriptive findings of this study showed that 83.56% of the diabetic patients demonstrated adequate diabetic foot care while 16.44% exhibited poor practices may have been influenced by economic constraints and limited access to healthcare resources, as highlighted by Sudha et al. [38]. In rural settings, patients may struggle to afford appropriate footwear or receive regular check-ups, which are critical for preventing foot complications. These findings suggest that while knowledge is a crucial factor, external barriers such as socioeconomic status and healthcare accessibility also play a significant role in determining whether diabetic patients can effectively manage their foot care.

As in this study, most of the respondents gain their knowledge regarding diabetic foot care practice via online information's, it is an urge for healthcare providers to further enhance those available platforms to be easily access by the community. Online platforms, including websites, social media, and video-sharing sites are also valuable resources for diabetic education. Educational videos, infographics, and live Q&A sessions with experts provide patients with knowledge on preventive foot care, helping them understand the importance of daily foot checks, proper footwear, and early detection of potential issues [15].

Social media platforms, such as Facebook and Instagram, also offer community-based support, where diabetic patients can share their experiences, ask questions,

and receive encouragement from others facing similar challenges. This peer support can be crucial for patients in rural areas who may feel isolated due to limited local healthcare resources. A study by Obilor et al. [39] found that patients involved in online diabetic foot care support groups demonstrated improved self-efficacy in managing their foot health, as the community engagement boosted their motivation to adhere to recommended practices. A study by Al-Hariri et al. [40] noted that patients from certain cultural backgrounds viewed diabetes as a predestined condition, which led to fatalistic attitudes towards foot care. This belief system can deter patients from adopting preventive measures, as they may perceive these actions as futile against what they consider an unavoidable progression of the disease.

Association between knowledge and practice of diabetic foot care

This study identified a large positive bivariate association between knowledge and practice of diabetic foot care (Pearson's $r = 0.65$, $p < 0.01$). Practically, respondents who knew more were substantially more likely to perform recommended daily behaviours (e.g., self-inspection, wearing protective footwear). The magnitude of this correlation indicates that improving knowledge is likely to yield meaningful gains in routine foot-care practice in rural settings, where early prevention is critical to reducing the risk of diabetic foot ulceration. This correlation supports existing literature that emphasises the role of education in improving health behaviours [19, 26]. The strength of the association is consistent with the profile of the sample. Most participants were ≥41 years, many had limited formal education, and internet sources were the dominant channel of information. In rural contexts with infrequent clinical contact, knowledge itself may act as a cue to action, helping individuals initiate and maintain preventive routines even when professional support is limited. Conversely, for those with lower health literacy, information may be harder to translate into daily habits without concrete, hands-on guidance. This aligns with the general understanding in healthcare research that knowledge serves as the foundation for behaviour change. Patients who are well-informed about the risks associated with poor foot care are more likely to adopt preventive measures. This suggests that educational interventions focusing on improving knowledge about diabetic foot care could directly impact patients' practices, potentially reducing the incidence of foot ulcers and other complications.

These findings are consistent with similar research conducted globally. For example, Bekele et al. [34] found that diabetic patients with higher levels of knowledge were significantly more likely to adopt preventive foot care practices, reducing the risk of ulcers and amputations. This is further supported by the work of and Tuglo et al. [19] and Drovandi et al. [26], who demonstrated that knowledge is fundamental to health behaviour change. Specifically, diabetic patients with a strong understanding of foot care principles are more likely to incorporate practices such as daily inspections, wearing protective footwear, and avoiding barefoot walking, which are essential in reducing the risk of foot ulcers. However, as this study suggests, educational interventions may be more impactful when accompanied by practical support addressing external barriers, such as affordability of diabetic supplies and regular healthcare follow-ups.

Distributional pattern and the knowledge–practice gap. Although 70.36% demonstrated good knowledge and 83.56% reported good practice, both distributions were polarised (no "moderate" band). A poor-practice subgroup (16.44%) persists despite generally favourable knowledge levels, indicating that knowledge is necessary but not sufficient for everyone. Likely barriers include footwear affordability and fit, reduced vision or manual dexterity (making inspection difficult), competing daily demands, and low self-efficacy. These factors can blunt the impact of education alone and explain why some individuals remain at risk.

By documenting a strong knowledge–practice link in a rural Malaysian community characterised by lower educational attainment and constrained access to services, this study extends that pattern to settings where the marginal benefit of targeted education may be greatest. The observed polarisation (good vs poor with no middle band) also adds nuance, highlighting a "left-behind" subgroup that requires adapted delivery rather than more of the same information.

Implications for practice in rural primary care

The findings of this study have significant implications for healthcare practice, particularly in rural communities where access to specialised diabetes care may be limited. Tailored educational interventions delivered by local healthcare providers, could effectively address gaps in both knowledge and practice. Community-based education programs focusing on diabetic foot care could be implemented in collaboration with local health centres and NGOs to ensure wider reach and sustainability. Additionally, regular follow-ups by healthcare professionals, particularly nurses, could serve as cues to action, prompting patients to engage in regular foot care practices. Patient education is important in the nurse's job. Education empowers patients to improve their health. When patients are involved in their care, they are more likely to engage in interventions that can increase their chances for positive outcomes. In this modern age, many patients take the opportunity to gain knowledge through the internet as a source of information stating that they learn a lot of new things about health and also improve their health level and increase their level of knowledge about their health [41].

As digital health continues to grow, it provides critical

opportunities for enhancing diabetic education and self-management, even in rural areas where in-person healthcare services are often limited. Digital health platforms offer flexible, cost-effective ways to disseminate information, improve patient engagement, and foster healthier practices related to diabetic foot care. The finding in this study has highlighted that the main sources of information on diabetic foot care was mainly from internet. Although access to technology may be challenging in some rural areas, the increasing availability of mobile phones, internet connections, and health apps has enabled more patients to use these platforms for health education. For instance, a study by Sadler et al. [42] showed that rural diabetic patients using a customised mHealth app experienced a significant increase in knowledge of foot care and self-management skills. The app provided personalised reminders and educational modules tailored to their literacy level, which helped them implement proper foot care practices. Such applications play a pivotal role in rural areas, where access to diabetes educators or podiatrists may be limited. In addition, many mHealth apps now include educational content on diabetic foot care, including video tutorials, interactive quizzes, and daily tips to reinforce self-care practices [43]. Somehow, from the findings, this study suggest that rural primary care should pair concise, plain-language education with practical execution supports to convert knowledge into consistent behaviour, especially for the small but important subgroup with poor practice. At each contact, clinicians can deliver a brief, standardised micro-curriculum (one to three key messages) using pictorial leaflets and a teach-back check to confirm understanding. This should be followed by hands-on coaching: a quick footwear assessment with simple fit criteria, and a one-minute, mirror-assisted daily inspection routine that patients practise in clinic before doing it at home. Between visits, habits can be sustained through low-cost cues (SMS/phone reminders or family prompts) and clear early-referral messages for new lesions or signs of infection. Where staffing is limited, community health workers can extend reach by conducting basic home foot checks and reinforcing the routine. Materials should be locally adapted (language and imagery) and distributed via trusted digital channels given the high reliance on online information. Finally, clinics should monitor a few sentinel behaviours (daily inspection, drying between toes, appropriate footwear outdoors) and use brief follow-ups to address barriers such as cost or dexterity, linking patients to affordable footwear options or assistive tools where needed.

However, with the expansion of mobile networks and the development of user-friendly applications designed for individuals with low health and digital literacy, these barriers are gradually being reduced [41]. Additionally, governments and non-profit organisations are increasingly investing in digital health initiatives targeted at rural populations, recognising the role of technology in improving healthcare access and outcomes.

Telemedicine has emerged as a vital tool in bridging the healthcare gap for diabetic patients in rural settings, providing them with access to specialist consultations and advice without the need for travel. Studies indicated that regular telemedicine consultations have been associated with better adherence to foot care practices and a decrease in severe foot complications among diabetic patients [44]. Telemedicine can facilitate early interventions by allowing patients to show images of their feet to healthcare providers for assessment, reducing the risk of complications by catching issues before they worsen. In a rural cohort, Toledo et al. [45] reported a 38% reduction in severe foot complications among patients who engaged in telemedicine visits, highlighting the potential of virtual consultations to improve outcomes in underserved communities.

Nevertheless, Gagliardino et al. [46] reported that the more than half of the participants (59%) preferred to receive diabetes-related education from medical professionals, highlighting the importance of healthcare provider-led education. The study's results also reinforce the value of professional guidance in enhancing patient self-care. Gagliardino et al. [46] both highlighted that direct education from healthcare providers leads to better self-care engagement and improved health outcomes. Regular follow-ups by healthcare providers, especially nurses, could serve as important cues to action, prompting patients to adhere to preventive measures. This approach supports findings by Berardinelli et al. [47], who noted that routine follow-up care in chronic disease management can significantly enhance patient adherence to preventive measures. Educational programs that involve community leaders and respect local cultural norms can be particularly effective in encouraging preventive foot care practices [6]. In many communities, diabetes carries a social stigma, which can discourage individuals from openly discussing their condition or seeking timely medical assistance for complications like foot ulcers. This reluctance to engage in preventive healthcare is often rooted in cultural perceptions of illness, where diabetes may be viewed as a personal failing or as an inevitable part of aging [48]. These beliefs lead to delayed treatment, ultimately increasing the risk of severe complications.

Moreover, collaborating with local organisations to provide subsidised resources, such as diabetic footwear or foot care kits, could alleviate financial burdens that often hinder effective foot care practices. By addressing both knowledge and resource barriers, healthcare interventions could achieve greater efficacy in reducing foot complications among diabetic patients in rural populations. In addition, Boelitz et al. [49] reported reductions in DFU incidence when mobile services paired education with basic foot-care supplies for low-income patients. Similarly, Van Veen et al. [50]

reported that mobile units can bridge healthcare gaps in underserved settings by delivering essential services where access is otherwise limited.

CONCLUSION

This study found a moderate-to-strong positive correlation ($r = 0.65$, $p < 0.01$) between knowledge and practice of diabetic foot care among rural Malaysian diabetics, confirming that education directly influences self-care behaviour. It fills an important gap by providing local empirical data from an under-studied rural population. The results further highlight that individuals with higher education levels and longer duration of diabetes demonstrated better foot-care practices, suggesting that both knowledge and experience influence preventive behaviour.

These findings emphasise the need for continuous diabetic foot-care education integrated within primary healthcare settings, especially targeting low-literacy and newly diagnosed patients. Future studies should employ longitudinal or interventional designs to determine causal pathways and test education models tailored to rural contexts.

Limitations and recommendations for study

This study employed a cross-sectional design, which provides a snapshot of participants' knowledge and practices at a single-point in time. This limits the ability to observe changes or trends over an extended period. Consequently, the study cannot assess the long-term impact of improved knowledge on sustainable behaviour change. Furthermore, the focus on a specific rural community may limit the generalisability of the results to other regions or populations with different socioeconomic or health conditions.

To address these limitations, future research should incorporate short longitudinal follow-up (3–6 months) to test whether gains in knowledge translate into sustained behaviour change. These steps would clarify the independent contribution of knowledge and identify leverage points for precisely targeted interventions. In addition, qualitative studies could examine the personal, social and cultural factors that influence diabetic patients' ability to adopt recommended foot care practices. Such research would deepen our understanding of the particular challenges faced by rural populations and help to develop more targeted and effective interventions.

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