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Foot care intervention delivered by community health worker (CHWs): A scoping review

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ABSTRACT

Variations of Community Health Workers (CHWs) interventions in diabetes self-management education (DSME) have been reviewed by many studies. In contrast, specific interventions regarding foot care intervention (FCI) are scarce and need to be explored further as one preventive measure to reduce diabetic foot problems in the community. This scoping review aimed to identify, and report nature of FCIs and the core components of FCIs delivered by CHWs. The scoping review was undertaken using PRISMA Extension for Scoping Reviews (PRISMA-ScR). The following electronic databases were searched for articles from data first indicated date through December 2022: CINAHL, EMBASE, Cochrane, Scopus, Web of Science, Theses ProQuest, PubMed, google scholar and other sources by using search terms related to foot care, community health workers, and diabetes mellitus. Descriptive synthesis was used to summarise the data. Nine studies from 1644 were included. All studies found that CHWs provided DSME in general, and foot care education was included. There was no detailed description of the core components of the intervention on foot care. Although, all studies might not provide detailed data on how CHW provided FCIs; the CHW intervention is an undoubtedly vital strategy to promote and prevent foot problems in medically underserved communities.

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Introduction

Diabetes affects 537 million adults aged 20 to 79 worldwide, with 783 million expected by 2045 (International Diabetes Federation (IDF), 2021). Up to one-third of the world's half-billion diabetics will develop a diabetic foot ulcer (DFU) at some point in their lives. More than half of DFUs will become infected, and 17% of these will require amputation (Armstrong et al., 2020). Diabetic foot ulceration can be defined as a full-thickness wound below the ankle in a person with Diabetes Mellitus (McGloin et al., 2021). Many DFUs do not heal and occasionally become recurrent, making this complication challenging to treat (Matricciani & Jones, 2015). People with DFUs experience more physical disability (Dorresteijn et al., 2010) and require more health service resources than people with diabetes who do not have foot problems. DFUs can lead to depression, significantly reduces patients' quality of life and result in an economic burden to the patients and health care system (Dorresteijn et al., 2010; Perrin et al., 2009)

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It is acknowledged that a significant proportion of high-risk foot complications are preventable (Diabetic Foot Australia, 2016). Patient education on appropriate self-care has the potential to play a crucial role in preventing foot complications (Perrin et al., 2009; RNAO, 2007) Preventative educational strategies targeted at foot health and reducing risk of complications are part of an approach that is often used to address lack of knowledge in individuals with diabetes, and to provide them with the information they need to care for their feet (Stevens et al., 2017). Interventions undertaken around the world demonstrate how substantial reductions in amputation rates can be achieved using innovative prevention strategies in diabetes foot care education (Diabetic Foot Australia, 2016).

The risk of leg amputations can be reduced by identifying those at risk of DFUs by simplified screening, and early recognition (Perrin et al., 2009; RNAO, 2007; Suh & Hong, 2015). Combining the two aspects of foot screening and self-foot care is essential for preventing DFU. Diabetic foot screening involves assessing a history of previous foot complications, deformities, pulse, foot lesions, and neuropathy. In addition, it is important for individuals to perform self-management of their feet regularly such as; foot examinations, foot hygiene and moisturisation, regular nail trimming and filing, suitable footwear both indoors and outdoors, exercise, and seeking professional care as needed (RNAO, 2007; Stevens et al., 2017).

Despite many recommendations, foot self-care practices are frequently neglected by patients (Stevens et al., 2017). Cross-sectional studies in low resources countries reveal that a low proportion of people diagnosed with diabetes engage in preventive foot self-care practices, such as inspecting feet daily, while a high proportion undertake potentially harmful practices, such as walking barefoot (Matricciani & Jones, 2015).

Interprofessional teams (physicians, nurses, and foot care specialists) are required to provide detailed and early patient assessment, aggressive treatment where needed, and education (Suh & Hong, 2015). However, a critical shortage of trained health workers, particularly in underserved areas around the world (WHO, 2020) means there are no resources to provide these services. To help reduce health disparities, the standards of care recommend that people with diabetes receive self-management support from lay health coaches, navigators, and Community Health Workers (CHWs) (American Diabetes Association (ADA), 2017). According to the World Health Report (2020), CHWs have the potential to contribute to the solution to the human resource crisis afflicting many countries' health systems. CHWs must be members of the communities where they live, selected by the communities, answering to the communities for their activities, supported by health system but not necessarily a part of its organisation, and having shorter training than professional workers (Lehmann & Sanders, 2007). CHWs perform a variety of functions, such as outreach, counselling, and patient home care, and serve as a resource for reaching and serving disadvantaged populations (WHO, 2020).

There is mounting evidence that CHWs have the potential to improve equitable access to care and health outcomes (Lehmann & Sanders, 2007; WHO, 2020). Many studies have evaluated CHW interventions in diabetes self-management in general (Culica et al., 2007; Hughes et al., 2016; Prezio et al., 2014; Spencer et al., 2011). Hughes et al. (2016) found that CHW interventions improved HbA1c levels, diabetes knowledge, self-care activities, medication adherence, Body Mass Index (BMI), blood pressure, and depression across multiple studies. However, the specific intervention for the role of CHWs in foot care education has rarely been studied. This scoping review aims to identify the nature of diabetic foot care interventions delivered by CHWs.

Method

This review used Joanne Briggs Institute (JBI) guidance for scoping review (Peters et al., 2020). A scoping review is used to synthesise evidence and assess the extent of the literature on a particular topic which can help to identify a topic area for a future systematic review (Tricco et al., 2018). A scoping review follows many of the same methodological steps as a systematic review. However,

quality assessment is atypical for a scoping review as the focus is on the findings of the study itself (Peters et al., 2020).

Inclusion and exclusion criteria

Types of participants

This scoping review only included literature on adult participants diagnosed with T2DM, as diabetic foot disorders are more common in adults, and self-management needs may differ for children (Stevens et al., 2017).

Concept

This review included CHW-delivered intervention. CHWs were either the sole focus of the intervention under study. This study included CHWs, known as health care providers with shorter training than Healthcare Professionals (HCPs). The CHW criteria used in this review were adopted from WHO's nomenclature in 2007 (Lehmann & Sanders, 2007). CHWs have fully featured as footcare educators in foot care intervention. Exclusion criteria eliminated studies that included non-CHW personnel (e.g. 'informal caregivers' and 'peer leaders') or those with team-based interventions when patients were educated by HCPs.

Context

The context of this review were foot care interventions for diabetic patients or footcare in diabetes self-management studies where footcare was included in educational programmes (e.g. diabetes in general) and where foot care intervention data was available.

Types of sources

Any study design written in English was eligible; the studies that did not have data concerning footcare or if their full-text versions were unavailable through the University of Nottingham Library service were excluded from this scoping review.

Search strategy and study selection

Using Medical Subjects Headings and text words, including diabetes mellitus, community health worker and footcare. The following search terms were adapted to match with the database search system using the following keywords below: (supplementary material 1).

('Community health workers' Or CHWs OR 'Lay Health workers' OR LHWs OR 'Volunteer health workers' OR VHWs OR 'Community health distributors' OR 'Community health surveyors' OR 'Community health assistants' OR 'Community health promoters' OR 'Promotoras de Salud' OR 'Kader') AND Diabetes Mellitus (Mesh) OR Diabetes AND ('Foot care education' OR 'Foot care' OR 'Diabetic foot care' OR 'Foot education' OR 'Diabetes foot care' OR 'Foot care knowledge' OR 'Foot self-care' OR Foot)

The following electronic databases were searched for articles from data first indicated date through December 2022: CINAHL, EMBASE, Cochrane, Scopus, Web Science, Theses ProQuest, PubMed, google scholar and other sources. A total of ten articles were identified that met the inclusion criteria above from 1643 articles.

Data extraction and quality assessment

All identified articles were collated and imported data into EndNote VX9.1 (Clarivate Analytics, PA, USA) subsequently when processes were searching databases and removing duplicate articles using the EndNote duplicate, following deleted articles manually after the author examined of the abstract of the study. After all duplicate removed from included data then titles and abstracts were screened by the first authors (OO) and checked by the second author (DN) for assessment against

the inclusion criteria for the review. The full text of the included studies was retrieved and assessed in detail against the inclusion criteria. Studies included after full-text review had in English and strictly about the topic area; evidence-based (e.g. containing references, description of evidence, and sources of evidence); and available and accessible for retrieval (supplementary material 2) using template source of evidence details, characteristics and result extraction instrument based on Joanna Briggs Institute.

Grey literature that was not primary research e.g. case reports and commentary papers were excluded from this review. Contact with the author of the selected article were started for missing information if needed. The critical appraisal of included studies was not applied because this review was aimed at a broader search within this topic (Peters et al., 2020; Tricco et al., 2018). PRISMA flowchart shows the search and selection procedure in Figure 1.

Data analysis and synthesis

The initial table was created by the first (OO) and second (DN) authors through data synthesis. Any disparities or variations in the table were resolved through discussion between the reviewers until a mutual agreement was achieved. Additionally, the two authors (SG and RW) analysed and interpreted the manuscript. This review presents the data in a narrative format, including tables and figures when appropriate, to facilitate data presentation (Grant & Booth, 2009) and aims to synthesise data but rather describe, categorise, and catalogue findings (Campbell et al., 2023).

The following results are presented in the evidence table: references, study design, population and, outcome categories of intervention and control conditions. Furthermore, intervention components are defined and reported following the checklist and template guide for the Description and Replication of Interventions (TIDieR) (Hoffmann et al., 2014). The TIDieR checklist provides a structured tool for intervention design, helping readers assess the reliability of findings (Hoffmann et al., 2014).

Result

Nature of foot care intervention delivered by CHWs.

Sample characteristics

Studies in this review were published between 2010 and 2017 (Table 1). This review involved 1353 participants, the sample sizes ranged from 41 to 325 participants (Mean (M) = 129.2). Study populations comprised 68.6% of female patients around middle-aged (mean of sample (Ms) = 53.1 years old). Most studies reported targeted minority populations in the US except one study conducted in underserved communities in urban settings in the Philippines (Paz-Pacheco et al., 2017). All studies conducted in the US aimed to address healthcare disparities in specific populations such as the Hispanic/Latino community (Castillo et al., 2010; Hughes et al., 2016; Spencer et al., 2011; Vaughan et al., 2017), Mexican American (Prezio et al., 2014; Rothschild et al., 2014), Bangladeshi immigrants (Islam et al., 2013) and a shortage of healthcare provider (Paz-Pacheco et al., 2017; Schoenberg et al., 2017). Two articles reported a study of the Diabetes Education Program for the same participants (uninsured Mexican Americans) (Culica et al., 2007) (Prezio et al., 2014) these studies were examined and analysed together as one study. Therefore, this report examined nine studies.

Foot care intervention delivered by CHWs

The focus of interventions was similar to those systematically reviewed by Trump and Mendenhall (2017) for general CHWs role in diabetes care (Trump & Mendenhall, 2017). The role of CHWs in patient education in diabetes management can be categorised into four types of service:

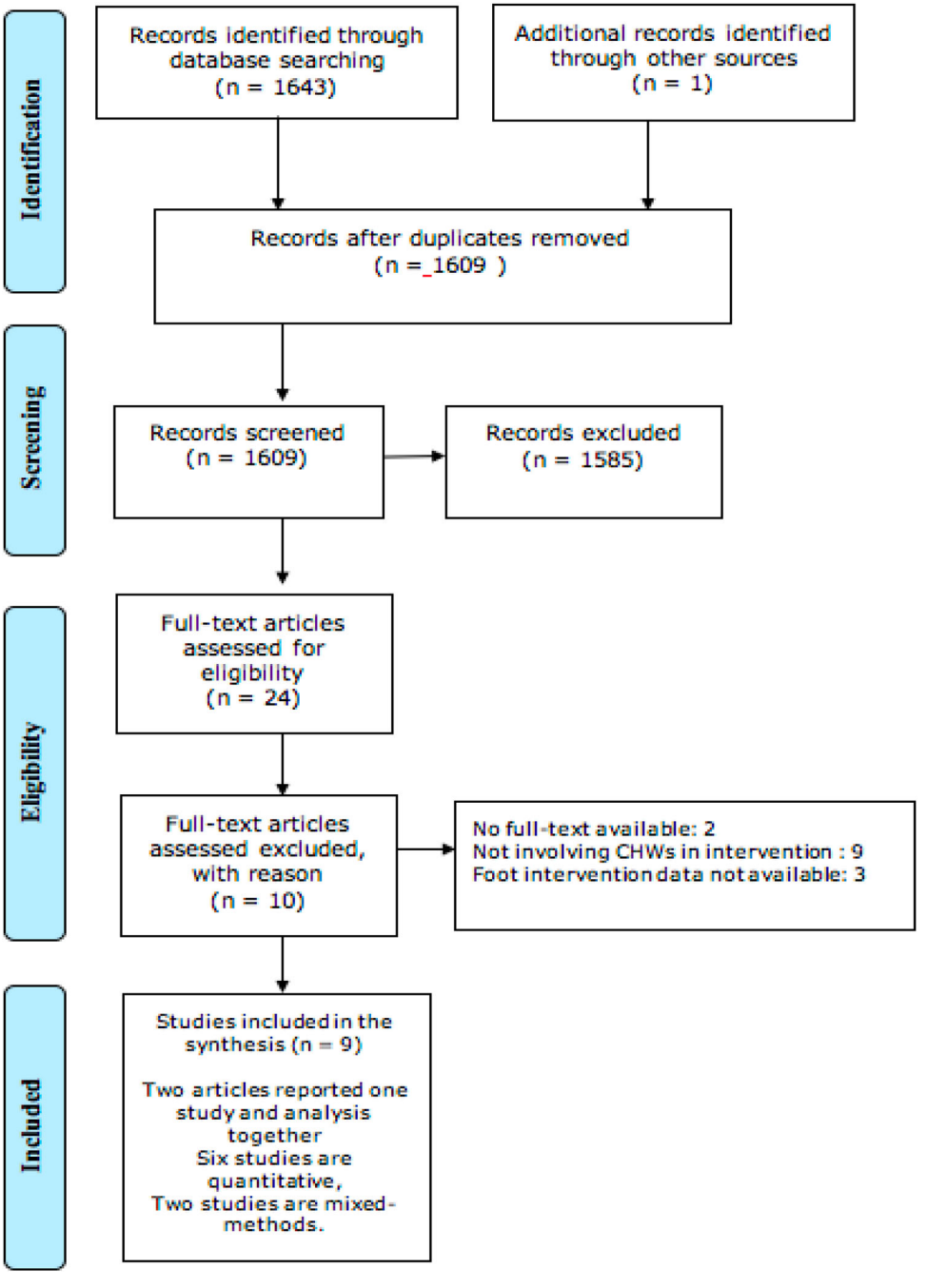

Figure 1. PRISMA Flow Diagram.

(1) Patient education – all included studies had similar findings in terms of the role of CHWs as health educators, having been trained in diabetes and its complications and lifestyle strategies for managing glycaemic control, such as nutrition, physical activity, blood glucose monitoring, and medication management.
(2) The second type of service was patient care and health management – all included studies explored this, particularly Hughes et al. (2016) and Spencer et al. (2011), this type of service

Table 1. Description of included studies DSME delivered by CHWs (FCI as part of DSME).

Author/ year	Country/ study setting	Study design	Sample size	Participant mean age in years	Aims and objectives	CHW role	Outcome finding	Type of footcare education	Significant changes in footcare education	Associated statistical significance (p; respective)/ effect size (if reported)
Vaughan et al. (2017) [23]	US Low-income Hispanics	RCT	62	42.5	The objectives of the study were: (1) to assess whether it is feasible to integrate CHWs as part of the leadership team and (2) to examine early evidence of the effectiveness of this integration in improving clinical outcomes and adhering to 8 ADA and USPTF guidelines.	Health educator Stress management	Baseline, 3-month, and 6-month A1C and lipid levels during the group visits (1) At month 6, the authors collected data on 8 standards of care per ADA and USPTF: (1) weight loss, (2) retinal screening, (3) comprehensive foot exam (i.e. assessment of foot pulses, sensation, skin exam), (4) BP, (5) urine microalbumin, and (6-8) cancer screening (breast, cervical, colorectal)	The CHWs provided complete foot exam	Comprehensive foot exam (i.e. assessment of foot pulses, sensation, skin exam) IG (%) 57.1 CG (%) 0.0	($P < .001$)
Schoenberg et al. (2017) [24]	US Kentucky	RCT	41 IG n = 20 CG n = 21	58	The pilot study aimed to improve T2DM outcomes in rural areas by measuring cost, retention, and satisfaction as primary outcomes.	Health educator Care coordinator (Patient Navigator-Appointment adherence)	HbA1c, BP, lipids, and BMI Self-management activities (blood glucose monitoring, diet, PA, footcare, medication taking, and medical appointment adherence). (3) (self-efficacy and patient activation). Spirituality/religiosity data	NR	Footcare was the best-managed domain of diabetes management, with participant checking their feet an average of 5.32 (SD = 2.10) days per week 5.70 (SD = 1,76) and 4.95 (SD = 2.92) for IG and CG respectively	$P = 0.38$
Hughes et al. (2016)[16]	US, Chicago Hispanic and non-Hispanic	Pre post-test single group	325	57	A diabetes intervention programme in	Health educator Home visits Patient care and	HBA1C, Biological/ clinical, behavioural and psychosocial,	NR	Footcare improvement in categorised	$P = <0.02$

	Black population	design. Case report			Chicago aimed to reduce HbA1c levels in adults with T2DM in the North and South Lawndale areas. The programme also sought to identify successful participant traits.	health management (create patient goal) Care coordinator Offered referral	diabetes self-care activities		diabetes self-care activities, comparison of diabetic participant characteristics for footcare at baseline and follow-up: baseline (5.3%), follow-up (6.2%), change difference 0.9% CI (0.5-1.2)	
Rothschild et al. (2014) [25]	US Mexican-Americans in metropolitan Chicago	RCT	144	53.7	This study assessed whether CHWs could improve glycaemic control among Mexican-Americans with diabetes.	Health Educator Home visits Patient care and health management (create a Patient goal)	Short-term physiological outcomes (mean HbA1c levels and percentage with controlled BP) Self-management behaviours, such as daily self-monitoring of blood glucose, medication taking, and adherence to diet and PA recommendations	NR	Summary of Diabetes Self Care Activities, d/wk Footcare: Mean ± SD (5.1 ± 2.7) IG: Mean ± SD (4.8 ± 3.0) CG: Mean ± SD (5.5 ± 2.4)	NR
Islam et al. (2013) [26]	US Bangladeshi migrants in New York City	Pre post-test single group design (mixed method, quantitative and qualitative)	26	53	The aim was to assess the effects and viability of a trial CHWP for enhancing diabetes management among Bangladeshi-American individuals with T2DM residing in New York City.	Health educator Home visits Care coordinator (appointment adherence)	Clinical, behavioural, and satisfaction measures Qualitative measures	NR	Frequency of checking feet and irritation increased from 27% to 77% daily between baseline and 12-months	$P = 0.026$
Spencer et al. (2011) [14]		RCT Randomized	183 Allocation: IG (n = 84), CG	52	Culturally-tailored intervention by	Health educator home visits,	Physiological measures, self-management	NR	The IG had significantly	$P < 0.01$

(*Continued*)

Table 1. Continued.

Author/ year	Country/ study setting	Study design	Sample size	Participant mean age in years	Aims and objectives	CHW role	Outcome finding	Type of footcare education	Significant changes in footcare education	Associated statistical significance (*p*; respective)/ effect size (if reported)
	US African-Americans and Latinos	IG and CG design	(n = 99) 6-month follow-up IG Active (n-59) CG Active (n = 77)		CHWs for low-income African-Americans and Latinos with diabetes. Aimed to improve HbA1c, BP, and lipid levels, diabetes knowledge, self-management behaviour, and diabetes-related distress compared to standard care.	Patient care and health management (create a patient goal) Care coordinator (appointment adherence)	knowledge, diabetes self- management, measured diabetes-specific psychological distress and diabetes self-efficacy scale		improved adherence to inspecting the inside of their shoes every day at the 6-month follow-up (49-77%; $P < .01$) and significantly improved compared with the CG	
Paz-Pacheco et al. (2017) [21]	Philippines Rural population	RCT Prospective, education-intervention trial	155 Recruited from villages. Randomized in DMSE IG (n = 80), and standard care CG (n = 70)	57	This study evaluates how effective DSME is in a rural agricultural town.	Health educator	Anthropometric, biochemical, health behaviours, and medication	NR	At baseline, the performance of foot examination was initially done by a fewer number of participants in the IG compared with the CG (24.10 versus 41.43%, $P = 0.0220$). After 3 months, IG performed more frequent foot examinations (76.56 versus 57.63%, $P = 0.0250$). After 6 months, there was no more difference in the proportion of participants in the	3rd month follow-up $P = 0.0250$ 6th month follow-up $P = 0.2310$

									two groups who perform foot examination (75.81 versus 85.11%, $P = 0.2310$)	
Castillo et al. (2010) [27]	Southeast Chicago, US Hispanics/ Latinos T2DM	Pre post-test single group design. Quantitative and qualitative	47	58	To conduct a diabetes education programme delivered by CHWs in community settings and to evaluate its effectiveness in improving glycaemic control and self-management skills in Hispanics/ Latinos with T2DM.	Health educator Patient care and health management (Health coaching) Home visits	Diabetes knowledge, Self-care behaviours, self-efficacy, depression, A1C, weight, and BP	NR	3-month post test results Check feet P-value = .005 Check inside of shoes P-value = < 0.000	$P < 0.000$
Prezio et al. (2014) and Culica et al. (2007) [15.28]	US Mexican-American	RCT	180 CG n = 90 IG n = 90	47	A programme led by CHWs aims to evaluate its effectiveness in managing and educating uninsured Mexican-Americans with diabetes while determining cost-effectiveness and complications improvements.	Health educator Patient care and health management (Health coaching)	Anthropometric, biochemical, health behaviours	The CHW performed a full foot examination, including visual inspection, assessment of pedal pulses and using monofilament	Intervention participants would experience significantly fewer foot ulcers at 5 years 10 and 20 years At 20 years, there would be significantly fewer foot amputations among IG Foot exam in prior 12 months Within-group IG $P < 0.001$ CG $P < 0.001$	Significantly fewer DFUs at 5 years ($p = 0,0014$), 10 years ($p = 0.001$), and 20 years ($p = 0.001$).

A1C: average blood glucose test, ADA: American Diabetes Association, BMI: Body mass index, CI: Confidence interval, CG: Control group, IG: Intervention group, NR: Not reported, RCT: Randomized Controlled Trial, SD: Standard deviation, USPTF: US Preventive Services Task Force.
Source: Author

included developing patient self-management skills, creating goals and action plans, identifying potential barriers, and problem-solving.

(3) Thirdly CHWs were involved in care coordination (Castillo et al., 2010; Hughes et al., 2016; Islam et al., 2013; Schoenberg et al., 2017; Spencer et al., 2011) in this role, CHWs reinforced instructions from participants' primary care providers and facilitated appointments and referral scheduling.

(4) Finally, CHWs supported patients with stress management (Islam et al., 2013) (Rothschild et al., 2014; Vaughan et al., 2017).

All of the studies describe the effectiveness of the patient education programme delivered by CHWs on diabetes in general (which included foot care education) through a variable number of education sessions ranging from two to 36 sessions. The content of the educational programme delivered consisted of diabetes self-management education (DSME), involving an overview of knowledge of diabetes, diet management, physical activity, diabetes complications, social support, stress management, and how to navigate the healthcare system. In one of these studies, DSME was combined with clinical navigation (Schoenberg et al., 2017) while in another a particular education programme was tailored to the culture of the immigrant population (Islam et al., 2013). Six studies used RCTs to establish the effectiveness of the intervention compared with usual care (Paz-Pacheco et al., 2017; Prezio et al., 2014; Rothschild et al., 2014; Schoenberg et al., 2017; Spencer et al., 2011; Vaughan et al., 2017). Other studies compared conditions at the baseline intervention (pre-test) with follow-up (post-test). Two studies (Castillo et al., 2010; Islam et al., 2013) used quantitative and qualitative methods by conducting interviews with the former participant after completing a one-group-repeated intervention.

The outcomes of the DSME interventions were primarily evaluated through the measurement of HbA1c levels and a combination of biological and clinical factors, as well as behavioural and psychosocial components. Foot care education was specifically assessed as part of the overall self-management activities, which included monitoring blood glucose levels, adhering to dietary guidelines, engaging in physical activity, practising proper foot care, taking medications as prescribed, and consistently attending medical appointments.

Most of the studies did not provide a clear and detailed description of the type of foot care intervention applied, specifically whether it consisted of foot screening or foot self-management. However, the Community Diabetes Education (CoDE) programme conducted by Culica et al. (2007) provided a comprehensive approach to foot care where CHWs were trained to perform a complete foot examination, including visual inspection, pedal pulses assessment, and monofilament testing. The examination results were documented in the patient's chart and clinical medical records, and any foot abnormalities were reported immediately to the physician. CHWs also provided education on appropriate footwear and daily home foot care. A similar approach was reported by Vaughan et al. (2017), reporting that CHWs performed a comprehensive foot examination, including the assessment of foot pulses, sensation, and skin examination.

Outcome variables

Outcome variables for specific interventions in foot care can be categorised into intermediate outcomes of self-care behaviour as part of diabetes self-care activities, measured by the frequency of the participants undertaking foot examinations. Most of the studies asked explicit questions to measure health behaviour change and used the Summary of Diabetes Self-Care Activities (SDSCA) to determine the frequency that participants checked their feet (Castillo et al., 2010; Culica et al., 2007; Islam et al., 2013; Prezio et al., 2014; Rothschild et al., 2014; Schoenberg et al., 2017; Spencer et al., 2011). The SDSCA is a brief, self-reported questionnaire concerning diabetes self-management, including items assessing the following aspects of the diabetes regimen: general diet, specific diet, exercise, blood-glucose testing, foot care, and smoking; it consists of a core set of 11 items. Respondents reported on the frequency with which they performed various activities over the

previous seven days (Toobert et al., 2000) which is unlikely to be sufficient to assess all patients' needs in preventing DFU.

Significant results for foot care education $p < 0.01$ were found in five studies (Castillo et al., 2010; Islam et al., 2013; Paz-Pacheco et al., 2017; Spencer et al., 2011; Vaughan et al., 2017). A study by Paz-Pacheco et al., 2017 in the Philippines found increased adherence to foot examination among the DSME group at three-month follow-up (76.56 versus 57.63%, $P = 0.025$). However, the intervention did not have a lasting impact as after six months, there was no difference in participants' adherence to foot examination between the two groups (75.81 versus 85.11%, $P = 0.231$) (Culica et al., 2007; Prezio et al., 2014). On the other hand, secondary analysis of data from an RCT which included 180 uninsured Mexican Americans with type 2 diabetes conducted in 2006 found that participants who received the intervention had a lower incidence of foot ulcers at 5 years ($p < 0.014$), 10 years ($p < 0.001$), and 20 years ($p < 0.001$). Moreover, at 20 years, there were significantly fewer foot amputations among those who received the intervention ($p = 0.005$). Additionally, both within the intervention group and control group, there was a statistically significant difference in the proportion of individuals who had undergone a foot exam in the prior 12 months ($P < 0.001$ and $P < 0.001$), respectively (Culica et al., 2007; Prezio et al., 2014). Rothschild et al., 2014 reported an increase in patients performing foot examinations after the intervention but no explanation about the statistical significance of these results.

CHWs' experience of footcare intervention

Some studies have explored CHWs' experiences in implementing the programme, including barriers, facilitators, recruitment, and retention of participants in the diabetes programme. Two studies (Castillo et al., 2010; Islam et al., 2013) used quantitative and qualitative methods. The first study included a Bangladeshi immigrant population in New York City; the CHWs provided a detailed log during a one-on-one which described interactions with the participant, documented clinical outcomes and barriers to accessing health care, and engaged in behaviours for improving diabetes management while proposing a follow-up plan. The study's evaluation included project staff, CHWs, and coalition members assessing the programme's strengths and weaknesses. Notes and transcripts from CHW interviews, meetings and retreats were coded using Narrative analysis, yielding themes about the importance of community, including CHWs' community concordance and leadership roles, as a critical factor that increased participants' trust in CHWs; these led to overcoming barriers and facilitating the acceptability and feasibility of the intervention (Islam et al., 2013).

Another study included Hispanic/Latino participants in the United States and employed a focus group discussion to illuminate the effectiveness of the diabetes programme participants. In contrast, CHWs' experience of delivering diabetes programmes was not captured and explored in this study because CHWs were not included in the focus group discussion (Castillo et al., 2010). Common themes were found in the study in Hispanic/ Latinos communities related to an increase in awareness of the programme, diabetes knowledge, diabetes self-management behaviour and self-efficacy. Patients mentioned specific information in foot care education.

' *I did not use to check my feet before. And I did not know I had to check them, and I asked here, and they told me, and I kept asking, and now I do it almost daily.*' (Castillo et al., 2010, p. 592). The overall acceptability, feasibility, and efficacy of the programme showed promise in Diabetes education programmes managed by CHWs.

The core component of DSME intervention including foot care

Intervention components are defined and reported following the checklist and template guide for the Description and Replication of Interventions (TIDieR) (Hoffmann et al., 2014). The intervention components include the method of delivery, procedure, intervention provider, location of intervention, place and duration of intervention, and intervention content (Table 2).

Table 2. Core components of DSME (footcare part of it) delivered by CHWs.

Author Year	Country/Study Setting	Place	Content of educational related to footcare	Provider	Method of delivery	Time and Duration
Vaughan et al. (2017)	US Low-income Hispanics	Community clinic	Diabetes overview; prevention of diabetes sequelae	GP (medical management) CHWs bilingual volunteers who live or work in the vicinity of the clinic Social support (CHW-led to address physical barriers to health; i.e. transportation, self-management skills) Mental health (CHW-led to address psychological barriers to diabetes; i.e. anxiety or depression)	Small groups (max. 10 participants), targeting: (1) medical management (i.e. individual appointment with the physician), (2) social support (CHW-led to address physical barriers to health; i.e. transportation, self-management skills), and mental health (CHW-led to address psychological barriers to diabetes; i.e. anxiety or depression)	The IG received 3-hour (Saturdays, 9 AM to 12 PM), monthly comprehensive diabetes group visits with CHWs integrated as part of the leadership team Follow-up after 6 months
Schoenberg et al. (2017)	Kentucky, US Appalachian population	Patient homes, project office, community locations	Part of the session in avoiding complication: feet, teeth, eyes, sick days, kidneys, BP	CHWs	Six participants for in-person, group-based self-management educational sessions	6-session programme 1 weekly session Follow-up months 2-6, month 7
Paz-Pacheco et al. (2017)	Philippines Rural population	Village health centre	The module of footcare as part of an 8-module DSME	Lay health advisors	CHWs deliver education with visual aids followed by group discussions with six to 15 participants in each session	NR Follow-up at 3 and 6 months
Hughes et al. (2016)	Chicago, US Hispanic and non-Hispanic Black population	Patient homes	NR	CHWs	Home visits for T2DM patients, develop individual management strategies and refer to clinic-based support	1 session, duration NR Follow-up at 12 months
Rothschild et al. (2014)	US Mexican-Americans in metropolitan Chicago	Patient homes	Five general self-management skills: brainstorming and problem solving, using a journal or written record, modifying the home environment to support behavioural change, seeking social support from family or friends, and managing stress	CHWs were bilingual Mexican-Americans who lived in the target community and worked for a local non-profit agency; non diabetes. No post-secondary education	Intervention: received a bilingual newsletter called Diabetes Action. Thirty-six mailed newsletters covered the AADE 7 topics and the 5 general self-management skills, Providing control: participants received the same number of contacts as received by those in the intervention arm and comparable DSME	Home visits lasting an average of 99 min, not including the time involved in transportation, missed appointments, and follow-up telephone calls CHWs delivered behavioural self-management training during 36 home visits over 2 years
Islam et al. (2013)	New York, US Bangladeshi migrants in NYC	Community outpatients, patient homes	Part of 6 sessions on diabetes complications and 'the	2 trained, bilingual Bangladeshi CHWs who are	CHW-facilitated group sessions on topics related to diabetes management with an average	6 monthly, CHW- facilitated 2.5-hour group sessions3 visits months 3, 6, and 9 of about 60

			importance of footcare for diabetes'	community leaders; 1 male, 1 female	of 5 participants per session and home visits	to 90 min eachFollow-up Follow-up 4, 5, 9, and 12 months
Spencer et al. (2011)	US African-Americans and Latinos	Community location	NR	Trained CHWs, known in this study as family health advocates	CHWs delivered DSME education and regular home visits and accompanied patients to clinic visits during the 6-month intervention period.	A 2.5-hour group in 7 sessions Follow-up at 6 months
Castillo et al. (2010)	Southeast Chicago, US Hispanics/ Latinos	Community self-care centre (nonclinical settings)	NR	CHW	Group and individual activities class sizes ranged from 10 to 15 participants, including family and friends	The sessions were scheduled every week for ten weeks and were led by a team of two CHWs (facilitator and assistant)
Culica et al. (2007); Prezio et al. (2014)	US Mexican-Americans	Community clinic; uninsured, faith-based urban clinic	NR	A specially trained, bilingual CHW	A long-term and low-cost one-to-one educational programme involving supportive family members to attend sessions	The educational intervention included three 60-minute initial visits and quarterly 30-60 min assessments, totalling seven patient contact hours over 12 months

Time and duration times of the intervention

All studies were of interventions where CHWs delivered DSME which included teaching about foot care. The intervention sessions were between 60 and 150 min. Study participants also received one-on-one visits from the CHW at months 3, 6, and 9, ranging from 60 to 99 min, to discuss diabetes management challenges and strategies with patients. One study offered home visits lasting an average of 99 min, not including the time involved in transportation, missed appointments, and follow-up telephone calls (Hughes et al., 2016; Spencer et al., 2011).

Intervention provider

Details of the Interventions including categories of interventions offered, the providers' expertise, background, and specialised training (Hoffmann et al., 2014). CHWs were referred to as trained CHWs (Culica et al., 2007; Prezio et al., 2014; Spencer et al., 2011) or bilingual CHWs (Culica et al., 2007; Islam et al., 2013; Prezio et al., 2014; Rothschild et al., 2014; Vaughan et al., 2017). Three studies (Culica et al., 2007; Paz-Pacheco et al., 2017) reported on how CHWs were trained prior to the intervention, while others only mentioned using trained CHWs. The trainers of CHWs were endocrinologists (Castillo et al., 2010; Paz-Pacheco et al., 2017) certified diabetes educators, and registered dietitians who were part of the university staff (Castillo et al., 2010; Culica et al., 2007; Islam et al., 2013) the method of learning was a didactic classroom (Culica et al., 2007) which was followed by one-on-one training (Culica et al., 2007; Prezio et al., 2014). The training duration ranges from 17 to 20 h of workshop combined with one-on-one or two-day workshops without specifying the number of hours spent on training. The education material covered diabetes knowledge, dietary assessment, meal planning, technical interviewing skills (Culica et al., 2007; Prezio et al., 2014), human subjects' protection, standard use of blood glucose metres, blood pressure monitors, and analyser tool for A1C evaluation, and use of written instruments for data collection and reporting (Castillo et al., 2010).

The CHWs passed a written final exam that included questions from the core curriculum of the American Association of Diabetes Educators. They received continuing education from the clinic's physicians during monthly case conferences and weekly chart reviews (Culica et al., 2007; Prezio et al., 2014). According to Islam et al., the CHWs' prior training and connection to the university were cited as credentials that facilitated trust with Bangladesh immigrant participants (Islam et al., 2013). Most studies reported that CHWs served primarily as educators in DSME in general, including foot care interventions (Castillo et al., 2010; Hughes et al., 2016; Islam et al., 2013; Paz-Pacheco et al., 2017; Prezio et al., 2014; Rothschild et al., 2014; Schoenberg et al., 2017; Spencer et al., 2011). Only one study reported that the CHW acted as part of the diabetes management team, but they were solely responsible for providing DSME and physiological support for diabetes patients (Vaughan et al., 2017).

The location of the intervention

CHWs primarily conducted their interventions in community settings such as village health centres, urban and faith clinics, community self-care centres, churches, schools, and senior centres (Castillo et al., 2010; Islam et al., 2013; Paz-Pacheco et al., 2017; Prezio et al., 2014; Schoenberg et al., 2017; Spencer et al., 2011; Vaughan et al., 2017). Three studies combined community-based interventions with home visits (Islam et al., 2013; Schoenberg et al., 2017; Spencer et al., 2011) while two other studies exclusively offered home visits (Hughes et al., 2016; Rothschild et al., 2014). In-person visits were conducted to facilitate clinic visits (Rothschild et al., 2014; Schoenberg et al., 2017), set specific goals for participants, support their progress, and improve communication skills and referrals (Spencer et al., 2011), and allowed the CHW to observe female participants in their home environment and provide tailored suggestions for dietary and physical activity changes, thus building trust and addressing life stressors (Islam et al., 2013).

Educational content including physical materials and information used in the interventions (Hoffmann et al., 2014)

The content of education on foot care as part of diabetes management was not explicitly mentioned in eight studies. Only one study included a specific foot care session (Paz-Pacheco et al., 2017). All of the studies discussed the overview of diabetes, including myths and facts, risk factors and information about the disease (Castillo et al., 2010; Hughes et al., 2016; Islam et al., 2013; Paz-Pacheco et al., 2017; Prezio et al., 2014; Rothschild et al., 2014; Schoenberg et al., 2017; Spencer et al., 2011), physical activities (Islam et al., 2013; Paz-Pacheco et al., 2017) and exercise (Islam et al., 2013) (Rothschild et al., 2014), seeking social support, and managing stress (Islam et al., 2013; Rothschild et al., 2014).

Method of delivery

This was primarily conducted through face-to-face sessions, typically organised in small groups of 5 to 15 individuals. Most of the studies reviewed involved multiple intervention sessions, ranging from 4 to 36 meetings. Three studies (Hughes et al., 2016; Prezio et al., 2014; Rothschild et al., 2014) utilised individual educational interventions, while Castillo et al. (2010) reported the involvement of family and friends in group interventions.

Tailored Intervention – who were the intervention personalised or adapted (Hoffmann et al., 2014)

Most studies employed culturally and linguistically adapted curricula for disadvantaged groups, underserved medical services, or minorities. Two studies also considered patient-level literacy (Prezio et al., 2014; Schoenberg et al., 2017), while another study was designed to assist patient navigation by assisting with obtaining clinic visits (calling the provider's office for appointments), making reminder calls, and facilitating transportation and dependent care (Schoenberg et al., 2017).

Barrier and facilitator to delivering the interventions

The studies provide evidence that CHWs can be employed to provide education to patients on self-management of diabetes. They are engaged in culturally appropriate relationships with underserved communities that lack access to adequate health services, which can help address disparities in healthcare access. However, several studies did not report significant changes in patient's behaviour in examining their feet daily. CHW interventions are closely linked to community settings and help facilitate and foster social support and patient self-efficacy to promote diabetes management (Islam et al., 2013). Among the challenges faced by participants in this study were minimal awareness and practical complications, including inadequate transportation, inclement weather, and increased stress and dependency among middle-aged adults due to the addiction epidemic in the US (Schoenberg et al., 2017), domestic issues among Bangladeshi immigrants in the United States included a lack of childcare for female participants and irregular work schedules for male participants (Islam et al., 2013). In the Philippines, conflicts in the timetable between project activities and other local social activity participants' inability to follow up due to domestic concerns (frequent trips to the villages as place of intervention), access to health centres, bad weather, and difficulties in disseminating information in communities with limited means of communication were some of the problems encountered (Paz-Pacheco et al., 2017).

Discussion

This scoping review has provided evidence on the nature of diabetes self-management interventions delivered by CHWs. Most of the studies included in this review were conducted in the US, with only one study conducted in an Asian developing country. The findings indicate that DSME interventions delivered by CHWs which include foot care education are effective. While the core

components of these interventions have been identified, the specific details of foot care interventions could not be described in detail. Self-management education is the cornerstone of treatment for all people living with diabetes whereas foot self-management programmes can be stand-alone initiatives, or components of general diabetes education programmes (Stevens et al., 2017).

We report varying CHWs' roles including health educator, health care coordinator, and providing psychological support as part of Non-Communicable Disease (NCD) prevention (Lehmann & Sanders, 2007; WHO, 2020). There was training for CHWs to deliver DSME education sessions in general. However, no description of training for CHWs to provide foot care education was reported in the studies. Training is an essential element of all CHW-led programmes (Koskan et al., 2013; O'Brien et al., 2009) and the issue of a lack of preparation and knowledge concerning particular health problems (e.g. diabetes) and patient needs is a commonly cited disadvantage of using CHWs (Aponte, 2015; Policicchio & Dontje, 2018; Sranacharoenpong & Hanning, 2011)

Furthermore, CHWs are ethnically, linguistically, socioeconomically, and experientially indigenous to the community in which they work, providing a unique understanding of the norms, attitudes, values, and strengths of community members (Vaughan et al., 2017). All studies applied a specific DSME curriculum tailored to the needs of the particular community, which has a different emphasis on each community. Tailoring the intervention to the context was a critical factor in ensuring the intervention's success (Skivington et al., 2021). In line with the CHW's position as a bridge between the community and the formal health system (WHO, 2020) the best intervention location is in community facilities including patients' home. The community sites were chosen to reduce travel costs and travel time and make services more accessible for underserved communities while there may be benefits of including interventions within neighbourhood programmes (Sloas, 2019), thereby increasing the uptake of diabetes care programmes (Horigan et al., 2017).

CHWs primarily conducted face-to-face sessions, which were usually organised in small groups of people. Individual patient education may be more cost-effective than group educational programmes in preventing diabetic foot ulcers (Monami et al., 2015). The current findings found positive outcomes from the DSME interventions in enhancing preventive foot care practice despite variability in target groups (i.e. participants' risk of foot ulceration), educators, mode of intervention (i.e. groups, individuals), intervention structures (intensive, home visit, phone call follow-up), multifaceted teaching strategies, whether theory-driven and content covered (Carpenter et al., 2019).

However, most of the identified studies were conducted in the US among ethnic minority populations facing barriers to healthcare access (Castillo et al., 2010; Culica et al., 2007; Hughes et al., 2016; Islam et al., 2013; Prezio et al., 2014; Rothschild et al., 2014; Schoenberg et al., 2017; Spencer et al., 2011; Vaughan et al., 2017). Medically underserved communities and health disparities in this context can give insights, with careful adaption, for developing CHW interventions for different context, particularly where the acceptability, barriers, and drivers of the capacity and agency of CHW to deliver such programmes are poorly understood since only two studies presented data on the acceptability of the education programmes offered. The primary limitation of these investigations was that their interventions may not be applicable to other populations with distinct demographic and socioeconomic features since they utilised culturally customised interventions.

Overall, no direct data described detailed foot care interventions provided by CHW. However, diabetic foot care educational interventions delivered by CHWs look promising as part of a strategy to promote and prevent foot problems in the community. Several components of the interventions can be applied to develop specific details of foot care interventions to specific contexts, especially for low and middle-income countries (LMIC), which have the broad advantage of established CHW programmes aimed at increasing access to healthcare.

None of the studies measured specific outcomes, such as incidence of foot ulceration and amputation, or clinical outcomes, such as callus development, fungal infection number, and incidence or duration of hospitalisation for diabetic foot problems. The foot care knowledge score or the patient behaviour assessment score were the outcome measures used to evaluate the effectiveness of patient

education to prevent diabetic foot ulcers. Still, they were only used in some of the studies investigated (Dorresteijn et al., 2010).

While the methodological procedures used in a scoping review are transparent and reproducible, similar to systematic reviews, the absence of quality assessment constrains the rigour of the review (Grant & Booth, 2009). This aspect could restrict their usefulness in aiding certain categories of policy determinations (Campbell et al., 2023).

This scoping review offers specific evidence on foot care interventions carried out by CHWs which can serve as preliminary evidence for programme planners interested in developing CHW programmes focused on foot care. However, no study was found on CHWs-delivered foot care intervention, resulting in no detailed information on the core components of foot care education interventions delivered by CHWs. Therefore, further investigations are needed to enhance our understanding of how CHWs can effectively deliver educational interventions for foot care.

Conclusions

Foot care education is part of DSME in general. Specific core components of DSME interventions might be employed in developing core components of foot care interventions such as place of intervention, delivery method, and tailored intervention. Nevertheless, the timing and duration alongside the intervention dose, intervention procedures, and educational content of foot care interventions need to be further elaborated with specific foot care interventions studies to gain a more comprehensive understanding in this area. However, diabetic foot care education delivered by CHWs is a promising intervention for improving diabetes foot management and related health outcomes in medically underserved communities.

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