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The feasibility of a social media-based foot self-management education and support program for adults with diabetes: A partially randomized preference trial

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ABSTRACT

Aim: To assess the feasibility of Diabetic Foot Care Group (DFCG), a social media-based self-management education and support intervention, for people with diabetes (PWD) empowerment in diabetes-related foot ulceration prevention.

Methods: A partially randomized preference trial was conducted among 32 PWD. DFCG was implemented through Facebook. Participants in the intervention group joined the DFCG in addition to their usual care, while the control group received usual care. Data were collected online using questionnaires on participants' DFCG acceptance, engagement and preliminary efficacy on nine diabetes foot care-related outcomes at baseline, one, and three months post-intervention.

Results: The participants' study intervention acceptability and engagement rates were 84.2% and 55.2%, respectively. DFCG efficacy rate compared to usual care was 88.9% to 22.2%. Three diabetes foot care-related outcomes increased significantly in the intervention group three-month post-intervention: foot self-care adherence ($p = 0.001$, $\eta_p^2 = 0.35$), preventive foot self-care practice ($p = 0.002$, $\eta_p^2 = 0.33$), and physical health status ($p < 0.02$, $\eta_p^2 = 0.23$).

Conclusion: DFCG is feasible and could effectively improve diabetes foot care-related outcomes.

Innovation: Social media is an innovative approach healthcare professionals could utilize to virtually support PWD in ongoing learning and engagement in optimal foot self-care activities.

Trial registration: ClinicalTrials.gov, Identifier: NCT04395521

1. Introduction

People with diabetes (PWD) are required to engage in lifelong practices such as regular foot inspection, hygiene, and regular visits with health care professionals (HCP) for foot screening to effectively prevent diabetes-related foot ulceration (DFU) [1]. However, suboptimal diabetes foot self-care adherence remains a significant factor contributing to DFU development and related health complications [2]. Many interventions, including patient education programs, have been implemented to improve PWD foot self-care behaviour and adherence to foot health recommendations [1,3]. Patient education is associated with increased diabetes foot self-care knowledge, confidence, and behaviour [4].

Emerging evidence from systematic reviews suggests that the effect of patient education programs is usually short-term and limited in sustaining a long-term reduction in the incidence of DFU [4,5]. The limited impact of patient education programs on the incidence of DFU could be attributed to the method of patient engagement in learning [6]. Most patients' educational programs often require patients to attend an average of one to two in-person community or hospital-based sessions with HCP for about two hours [7-9]. In addition, the content of most DFU preventive education programs primarily focuses on the exchange of disease-specific information between the patients and the HCP. Therefore, the modality of current diabetes foot education programs

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could influence the development of day-to-day empowerment skills critical to sustaining ongoing patients' adherence to foot care recommendations.

According to the International Working Group on the Diabetic Foot (IWGDF) guideline on the prevention and management of diabetes foot disease, patient education programs play a significant role in DFU prevention if they are presented in a structured, organized, and repeated manner [10]. Alternative effective interventions that could support PWD's ongoing engagement in DFU prevention need to be identified. Effective chronic disease self-care support interventions for patients often focus on self-management and combine education with other psychosocial or behavioural change interventions (e.g., peer leader involvement, social support, group interaction, and community resource links) [11,12]. Self-management embodies strategies that include problem-solving, decision-making, utilizing resources, collaboration with HCP, taking action, and self-tailoring used by individuals to assume the daily responsibilities for managing their health [13,14].

The global prevalence of DFU is 6.3%, with Canada ranking second highest (14.8%) [15]. DFU-related complications account for 2.1% of global years lived with disability [16]. PWD practice of foot self-care activities in Canada is suboptimal [17,18]. A social media-based program tagged 'Diabetic Foot Care Group (DFCG)' was developed in line with IWGDF guidelines to continuously engage PWD in optimal foot self-care and DFU prevention in Canada. Social media has evolved due to the advancement in technology into an extensive information and communication tool that has the potential to support PWD in foot self-management and enhance PWD foot care adherence [19]. Studies, including randomized controlled trials, have evaluated the impact of social media on diabetes self-management [20-23]. Despite the high variability of the design and quality of studies, social media was associated with improved glycated hemoglobin [21-23], quality of life [20-22], and self-care knowledge [22] among PWD.

A few descriptive studies that analyzed diabetes foot care-related content on social media platforms such as Facebook, Twitter, and YouTube have confirmed its utility in helping PWD learn about important DFU preventive strategies [24-26]. However, the effectiveness of using social media to facilitate healthcare-oriented interventions for PWD prevention of DFU is unclear. Therefore, there is a need to explore the feasibility of using social media as an alternative method to deliver structured self-management education and support programs for PWD's ongoing learning and motivation in foot self-care and DFU prevention. A feasibility study is the preliminary exploration of the practicality of a proposed intervention, including its efficacy, for provisional evidence of its effectiveness among the intended population that could inform future research and clinical decisions [27]. This study aimed to determine the feasibility of DFCG by exploring its acceptance, participants' engagement and its preliminary efficacy in improving diabetes foot care-related outcomes among PWD.

2. Methods

2.1. Design

This feasibility study utilized a Partially Randomized Preference Trial design involving two groups. This design falls within the pragmatic trial continuum that focuses on understanding how an intervention works in real life [28]. The design enables participants to choose to be part of the intervention or control group based on their preference or be randomized if they do not have a preference using a web-based program (Random Allocation Software version 1.0) [29]. Given social media's ubiquitous nature, a pragmatic approach is considered appropriate and thus could favourably influence real-life clinical decision-making [28].

2.2. Participants

The study was conducted online. Inclusion criteria were diagnosis of diabetes mellitus (DM) and being 18 years or older; resident in Canada; owning or willing to create a Facebook account; having access to the internet, computer/smartphone and email; and speaking and writing in English. People were not eligible if they did not provide follow-up contact information or completed <60% of the baseline survey.

2.3. Sample size

The sample size was informed by literature recommendations suggesting a total sample size of between 24 and 100 participants for feasibility studies [30]. Based on this, the aim was to recruit 100 participants into this feasibility trial to determine associations or differences in the feasibility indicators if they existed.

2.4. Recruitment procedure

The initial recruitment plan was to recruit participants directly from the diabetes clinics in the study setting starting in August 2020. However, due to the COVID-19 pandemic and control policies, we were unable to obtain approval from the clinic management team for participant recruitment. The recruitment strategy changed to online in November 2020. Information about the study and a request for participation was publicized from November 2020 to September 2021 through research partner's website/mailing list, social media, peer-reviewed journal [31], and magazines of organizations that support people with chronic diseases. The study web page contained a secured survey link through which interested participants completed the consent/eligibility screening survey and provided follow-up contact details (email and phone number). All eligible participants were contacted via email with information about their recruitment and a survey link to complete the baseline assessment and choose the study group or opt to be randomized. However, due to low participants' responses to the baseline survey, the consent/eligibility and baseline assessment surveys were merged in April 2021 to facilitate more participant recruitment. Also, the recruitment duration was extended from three to twelve months due to low participant recruitment. Upon completion of the baseline survey, participants were contacted via email within a week regarding their enrollment, allocated study group, and instructions on how to proceed to the next study stage.

2.5. Study programs

2.5.1. Usual care

Participants who selected or were randomized to the control group continued to receive their usual care and did not have access to DFCG. Usual care is routine diabetes care that may include education and foot care services offered to the participants in their various diabetes clinics in-person or virtually but not through social media platforms.

2.5.2. Intervention

Participants who selected or were randomized to the intervention group joined DFCG in addition to their usual care. DFCG is a self-management education and support program comprising four components based on Social Cognitive Theory: education, peer support, social or group interaction, and active engagement implemented through a private Facebook group platform. Members' information and discussions in private Facebook groups are not visible to the public. Details of the intervention development and implementation, including privacy measures, have been described in another paper [32]. The education content comprised information on diabetes/DFU overview, DFU risk factors and consequences, preventive strategies, foot care team, nutrition, exercise, mental health, and management of DFU and related complications. Social support in DFCG was achieved through group discussion and the involvement of a trained peer leader (a person with diabetes) who shared personal stories to motivate participants in foot self-care. Patient education/social support was implemented using 2 or 3 posts daily for

three months instead of the initially planned 2 to 5 posts to avoid information burden and encourage optimal participants' engagement. DFCG was closely monitored and moderated by the peer leader and lead author (a registered nurse), who engaged and answered participants' questions.

2.6. Outcome

The primary outcomes were a) acceptance of the DFCG, (b) engagement level and pattern in the DFCG, and (c) preliminary efficacy in improving participants' diabetes foot self-care adherence.

The secondary outcomes were the preliminary efficacy of DFCG in improving other diabetes foot care-related outcomes, including foot self-care efficacy, communication with HCP about foot health issues, awareness of community resources, perceived foot health status, and quality of life among PWD.

2.7. Measures

The data collection tool in this study involved questionnaires administered via Qualtrics© survey software. Socio-demographics data and health history were collected at baseline in both the control and intervention groups. Socio-demographics data and health history questionnaire contained 31 items, including questions from the Diabetes Foot Care Questionnaire for history of foot problems [33] and the Patient Health Questionnaire-2 for depression evaluation [34].

DFCG acceptance was assessed among the participants in the intervention group one month after enrolment into the study using a questionnaire developed by the first author based on factors identified in DeLone and McLean's Information System Success Model – information quality, system quality, perceived usefulness, and overall satisfaction [35]. Also, the acceptance tool measured participants' willingness to continue their membership and recommend the group to others. The research team assessed the acceptability tool face and content validity, which led to rewording of five items.

Participants' engagement level in DFCG was assessed three months after enrolment into the intervention group. Engagement data was collected manually by counting the number of people who read the study posts, reacted, commented, posted, or voted in the poll questions in DFCG.

Preliminary efficacy focused on exploring evidence of effectiveness of DFCG on nine diabetes foot care-related outcomes, that is, the percentage of outcome variables that improved from baseline to post-intervention. The primary and secondary preliminary efficacy

Table 1
The assessed feasibility outcome and measuring instruments' characteristics.

Outcome	Measurement tool	Scale	Psychometric properties	Expected score range
Acceptability rate	Questions developed by authors based on factors in DeLone and McLean's Information System Success Model [35]	25 items on information quality (7 items on a 4-point Likert scale), system quality (8 items on a 4-point Likert scale), perceived usefulness (7 items on a 4-point Likert scale), satisfaction (1 item on a scale of 0–10) and membership continuation/ recommendation (2 items with yes/no scale). A higher score indicates higher intervention acceptance.	Not assessed	22–100
Engagement rate and pattern	Participants' activities in DFCG: the number of posts viewed, reactions (comments and likes), and poll responses.	Not applicable	Not applicable	Not applicable
Preliminary efficacy				
• Foot self-care adherence	Adapted Foot Self-Care Behaviour Tool [36].	17 items on preventative foot care practices and potentially foot-damaging behaviours. The adaptation entailed changing the response scale from a 6-point (twice a day, daily, every other day, twice a week, once a week, or never) to an 8-point Likert scale (none, once, twice, thrice, four, five, six times a week, and daily). A higher score indicates high preventive foot self-care practices, while a higher score indicates low potentially foot-damaging behaviours.	Internal consistency of 0.58 and 0.32 with a reliability of 0.76 and 0.46 for preventative foot care practices and potentially foot-damaging behaviours, respectively [36].	0–87
• Diabetes foot self-care efficacy	Foot Care Confidence Scale [37]	12 items on a 5-point Likert scale (strongly confident, moderately confident, confident, moderately not confident, and strongly not confident). A higher score indicates higher confidence.	Content validity index of 100% and reliability of 0.92 [37]	12–60
• Community resources awareness	Numerical Rating Scale	One item on an 11-point rating scale ranging from 0 (lowest ability) to 10 (highest ability).	Not applicable	0–10
• Participants' communication with HCP	Adapted questions from Stanford University Chronic Disease Self-Management Program Communication with Physicians' Tool	Three items on a 6-point Likert scale (never, almost never, sometimes, fairly often, very often, and always). The tool adaptation entailed rephrasing item 1 and 3 to focus on diabetes foot disease. A higher score indicates a higher level of participant communication with HCP.	Internal consistency of 0.73 and a reliability coefficient of 0.89 [38]	0–15
• Perceived foot health status	Foot Health Status Questionnaire questions 9 and 12	Two items on general foot health with a 5-point Likert scale (excellent, very good, good, fair, and poor). A higher score indicates a higher perception of their feet being healthy.	Internal consistency of 0.88, interclass correlation of 0.78 and comparative fit index of 0.96 [39]	2–10
• Quality of life	Medical Outcome Study Short Form health survey tool (SF-12v2) - one-week recall version	12 items that measure physical and mental health status with mixed Likert scale of 3–10-point response scale. A higher score indicates higher physical and mental health status.	Internal consistency of 0.85 and 0.83 and test-retest reliability of 0.72 and 0.63 for physical and mental health status among people with diabetes, respectively [40]	0–100

outcome variables were assessed at the baseline and three months after enrolment in the intervention and control groups. Diabetes foot self-care adherence was assessed with an adapted Foot Self-Care Behaviour Tool, which measures nine preventive self-care practices with questions asking about frequency of behaviours such as examination of their feet and shoes, foot hygiene (washing and applying moisturizer), and the habit of changing into clean socks. The questionnaire also incorporated questions pertaining to eight potentially foot-damaging behaviours, such as walking barefoot indoors/outdoors, wearing shoes without socks, and using chemical agents or sharp instruments to remove corn/callus [36]. Foot self-care efficacy was measured with Foot Care Confidence Scale [37]. Participants' communication with HCP about their foot health was assessed using an adapted Stanford University Chronic Disease Self-Management Program Communication with Physicians' Tool [38]. Community resources awareness was assessed by asking the participants to rate their ability to locate and utilize available resources in their community for DFU prevention. Perceived foot health status was measured using the Foot Health Status Questionnaire [39]. Finally, quality of life was assessed using the Medical Outcome Study Short Form health survey (SF-12v2), valid among PWD [40] and measures physical and mental health status (licence number QM053029). See Table 1 for the detailed feasibility outcome measuring tool characteristics, including psychometric properties, scale, and expected score range.

2.8. Data analysis

Data were analyzed using Statistical Package for the Social Science (SPSS©) version 27. Participants' socio-demographic characteristics, health history, DFCG acceptance and engagement were described using frequencies, means and standard deviations. Feasibility outcome variable (acceptability, engagement, and efficacy) scores were scaled as continuous variables, and each total was converted to a percentage. A score $>70\%$ was set as the cut-off point for acceptability outcome. Given that there are no established theoretical or empirical cut-off points for measures of acceptance of digital interventions, the research team assumed scores above 70% to indicate a high level of participants' acceptance and vice versa [41]. The engagement rate was estimated based on the weekly total number of participants. In addition, the participants' engagement rate score was categorized based on the Facebook group engagement classification as high ($\geq 80\%$), moderate (50–79%), and low (0–49%). Facebook considers groups with an activity level of 80% a highly engaged group [42]. For intervention efficacy on diabetes foot care outcomes, a *t*-test was conducted to determine the difference between groups at baseline and post-intervention. Pearson correlation for continuous variables and Eta coefficient test for categorical variables was conducted to determine the relationship between socio-demographic/health characteristics and outcome variables post-intervention. Analysis of covariance (ANCOVA) was used to control the effect of the participants' socio-demographic/health characteristics and baseline outcome scores on the association between the study programs and outcome variables post-intervention. p-value ≤ 0.05 was determined to be the level of significance.

2.9. Ethics considerations

The study was approved by Queen's University Health Sciences and the Affiliated Teaching Hospitals Research Ethics Board (#6029718). Consent was obtained online by clicking 'yes' to the question, 'Have you read the letter of information and agree to participate in this study?' In line with the study protocol, a member of the research team contacted participants who met the criteria for a provisional depressive disorder on the PHQ-2 or reported having ulcers, cuts, sores, or blisters on their feet to follow up with their primary healthcare provider for further assessment.

3. Results

3.1. Participant recruitment

A total of 144 people were assessed for eligibility; 48 PWD met the inclusion criteria. Thirty-two out of 48 eligible participants completed the baseline assessment and were enrolled in the study between February and June 2021. Twenty-three participants were allocated to intervention group (IG) and nine to control group (CG). Each participant was followed up for three months after entry into the trial (February to October 2021). Twenty-nine (60.4%) participants completed the 3-month follow-up assessment. The study participant flowchart is presented in Fig. 1.

3.2. Participants' demographic and clinical characteristics

At baseline, there were no significant differences in participants' socio-demographic and health characteristics between IG and CG except for sex (Table 2). The IG had a higher percentage of female participants (73.9%), and the CG had more male participants (66.7%). Participants' age ranged from 24 to 77 years, with 93.8% ($n = 30$) of the sample being >50 years old (IG: $\bar{x}=56.65 \pm 11.36$, CG: $\bar{x}=61.56 \pm 6.88$, $p = 0.24$). Most of the participants had a diagnosis of type 2 DM (IG: $n = 18$ [78.3%], CG: $n = 8$ [88.9%]). Also, most participants had moderate DFU risk level (IG: $n = 16$ [69.6%], CG: $n = 4$ [44.4%]).

3.3. Participants' acceptance of DFCG

Nineteen of the participants in the IG completed the acceptability assessment survey. Table 3 shows that 94.7% of the participants found the information in the DFCG to be valuable, easy to understand, and clear. Feedback on the postings, group discussion and the facilitators' involvement was mostly positive. There were seven questions focused on the usefulness of the DFGC. Most participants agreed that the DFGC had enabled them to develop the skills, confidence and motivation to engage in healthy behaviours in DFU prevention. The mean participants' ratings of the quality of DFCG information, structure and perceived usefulness were 85.3 ± 10.4 (range, 67.7–100), 82.9 ± 10.7 (range, 71.9–100), and 80.3 ± 12.0 (range, 57.1–100), respectively. Participants' satisfaction ranged from 60 to 100 ($\bar{x}=84.1$, SD = 13.7). Most participants met the cut-off point for each acceptability component and agreed to continue their membership and recommend DFCG to others (Fig. 2). Overall, participants' intervention acceptance mean score was 81.9 ± 10.5 (range, 64–99), with 84.2% scoring above the cut-off point ($n = 16$).

3.4. Participants' engagement in DFCG

The total number of posts in DFCG during the study period was 578. An average of 9.6 participants clicked and read each post (SD = 2.2, range = 3–18); this in relation to the daily total number of participants in DFCG, indicated that an average of 59.7% of participants read a post (SD = 19.1, range = 13–100%). Each participant read an average of 217 posts throughout the study period (SD = 169.8, range 7–544). In addition, six participants' posts were approved and shared in DFCG. Nineteen participants (82.6%) made 57.4% of the comments in DFCG ($n = 222$). Participants' comments ranged from 1 to 41 per week ($\bar{x}=7.2$, SD = 8.1). The number of participants' reactions through emojis ranged from 10 to 50 per week ($\bar{x}=30$, SD = 10.2). Also, the expressed reactions varied (944 likes, 35 wow, 21 love, 18 care and 5 sad emojis). Ninety of the posts in DFCG were poll questions, and collectively, twenty-one participants voted (91.3%), with a mean of 6.3 participants answering each poll (SD = 1.9, range = 1–11). Overall, the weekly engagement rate ranged from 24.0 to 90.9% ($\bar{x}=55.2$, SD = 24.0).

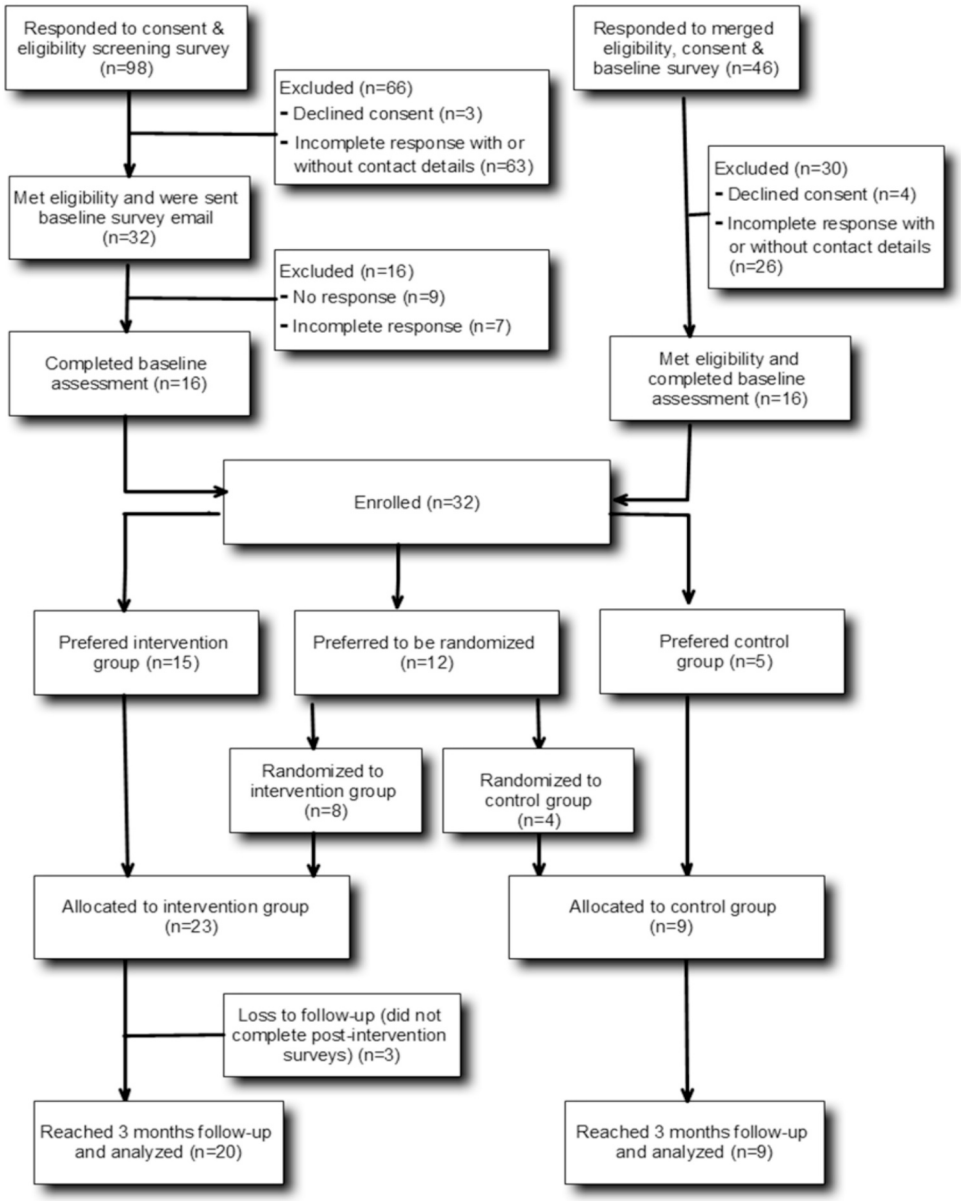

Fig. 1. Study participant flowchart.

3.5. *Preliminary efficacy of DFCG*

The mean scores and effect of the study programs on diabetes foot care-related outcomes are presented in Table 4. The group comparison at baseline (T1) revealed no significant difference in the mean score of the assessed diabetes foot care-related variables between the IG and CG. At the 3-month follow-up (T2), there was a significant difference in participants' adherence to foot self-care recommendations (IG: $\bar{x}$=75.4 ± 14.7, CG: $\bar{x}$=59.8 ± 13.3, $p = 0.01$) and preventive foot self-care practice (IG: $\bar{x}$=72.8 ± 18.9, CG: $\bar{x}$=47.3 ± 16.0, $p = 0.002$), with the participants in the IG having higher scores than the CG participants. Also, for other assessed diabetes foot care-related outcome variables at T2, participants in the IG had higher scores than the CG participants except for community resource awareness and mental health status; however, this difference was not significant. The within-group comparison (paired samples *t*-test) from T1 to T2 revealed a significant increase in IG participants' foot self-care preventive practice ($t(19) = -3.65, p = 0.002$), adherence ($t(19) = -4.16, p = 0.001$), perceived foot health ($t(19) = -3.22, p = 0.01$), and physical health status ($t(19) = -2.90, p = 0.01$). In the CG, foot-damaging behaviours ($t(8) = 2.93, p = 0.02$), community resources awareness ($t(8) = -3.11, p = 0.01$), and mental health status ($t(8) = -1.20, p = 0.26$) increased from T1 to T2.

After controlling for the baseline scores and participants' characteristics with a moderate or significant relationship as covariates using ANCOVA, the number of diabetes foot care-related outcomes with a significant difference increased from two (Table 4) to three (Table 5) to include physical health status ($p = 0.02$) at T2, with participants in the IG having higher mean score than the CG. Also, the three outcomes with a significant difference at T2 had a large effect size (partial eta squared of 0.35 for foot self-care adherence, 0.33 for preventive foot self-care practice, and 0.23 for physical health status).

For the overall intervention efficacy rate, eight of the nine (88.9%) assessed diabetes foot care-related outcomes improved among the IG participants at T2. While in CG, only two (22.2%) diabetes foot care-related outcomes improved among the participants.

Table 2
Participants' socio-demographic and clinical characteristics.

Participants' characteristics		Intervention group (n = 23)	Control group (n = 9)
Sex:	Male	6 (26.1%)	6 (66.7%)
	Female	17 (73.9%)	3 (33.3%)
Age (years): mean ± SD; range		56.65 ± 11.36; 24–77	61.56 ± 6.88; 52–71
Diabetes:	Type 1	5 (21.7%)	1 (11.1%)
	Type 2	18 (78.3%)	8 (88.9%)
Duration of diabetes (years): mean ± SD; range		10.04 ± 8.83; 0–29	10.78 ± 8.44; 2–26
Ethnicity:	White	18 (78.3%)	7 (77.8%)
	Asian	2 (8.7%)	–
	Black	1 (4.3%)	2 (22.2%)
	First Nations	2 (8.7%)	–
Education:	Completed high school	3 (13.0%)	1 (11.1%)
	Some coll./ undergrad educ.	2 (8.7%)	2 (22.2%)
	College diploma	7 (30.4%)	3 (33.3%)
	Baccalaureate degree	9 (39.1%)	2 (22.2%)
	Graduate degree	2 (8.7%)	1 (11.1%)
Living arrangement:	Living alone	5 (21.7%)	1 (11.1%)
	Living with spouse/partner	15 (65.2%)	5 (55.6%)
	Living with others	3 (13.0%)	3 (33.3%)
Province of residence:	Alberta	2 (8.7%)	–
	British Columbia	2 (8.7%)	2 (22.2%)
	Newfoundland & Labrador	2 (8.7%)	–
	Nova Scotia	1 (4.3%)	–
	Ontario	13 (56.5%)	6 (66.7%)
	Prince Edward Island	1 (4.3%)	–
	Quebec	1 (4.3%)	1 (11.1%)
	Northwest Territories	1 (4.3%)	–
Comorbidity:	Absent	5 (21.7%)	3 (33.3%)
	Present	18 (78.3%)	6 (66.7%)
History of diabetes-related foot ulceration:	No	17 (73.9%)	7 (77.8%)
	Yes	6 (26.1%)	2 (22.2%)
Active diabetes-related foot ulceration:	No	20 (87.0%)	7 (77.8%)
	Yes	3 (13.0%)	2 (22.2%)
History of lower limb amputation:	No	19 (82.6%)	9 (100%)
	Yes	4 (17.4%)	–
DFU's risk level:	Low	1 (4.3%)	2 (22.2%)
	Moderate	16 (69.6%)	4 (44.4%)
	High	6 (26.1%)	3 (33.3%)
Depression:	Negative	18 (78.3%)	7 (77.8%)
	Positive	5 (21.7%)	2 (22.2%)
Previous foot care education:	No	5 (21.7%)	4 (44.4%)
	Yes	18 (78.3%)	5 (55.6%)
Social media usage per week:	≤ 4 days	1 (4.3%)	1 (11.1%)
	5–6 days	1 (4.3%)	3 (33.3%)
	Daily	21 (91.3%)	5 (55.6%)
Perceived social media as a useful health tool:	Yes	22 (95.7%)	7 (77.8%)
	No	1 (4.3%)	2 (22.2%)

Note: Coll./undergrad educ = College or undergraduate education.

Table 3
Participants' DFCG information content, structure, and perceived usefulness rating.

Items	Disagreed	Agreed
	n (%)	n (%)
DFCG information content quality		
The information posted is valuable for achieving healthy feet*	–	18 (94.7)
The information posted is easy to understand*	–	18 (94.7)
The information posted is clear*	–	18 (94.7)
The information posted is overwhelming*	15 (78.9)	3 (15.8)
Group discussion is informative*	–	18 (94.7)
Group discussion is relevant to promote the daily practice of foot self-care and prevention of DFU*	1 (5.3)	17 (89.5)
Group discussion motivates healthy behaviour and practice of the recommended foot self-care activities*	1 (5.3)	17 (89.5)
DFCG structures quality (multimedia, links, and group members)		
Texts, videos, and photos posted are appealing*	1 (5.3)	17 (89.5)
Texts, videos, and pictures posted are relevant and informative*	–	18 (94.7)
Posts or discussions in the group are engaging*	1 (5.3)	16 (84.2)
Educational and community resources links are accurate*	–	17 (89.5)
Members are respectful and supportive*	–	17 (89.5)
Facilitators respond promptly to members' questions*	1 (5.3)	16 (84.2)
Facilitators adequately monitor group activities*	–	17 (89.5)
The group platform is secure*	1 (5.3)	16 (84.2)
Perceived usefulness of DFCG		
The DFCG has helped or enabled me:		
Understand personal risk for diabetes foot problems*	1 (5.3)	16 (84.2)
Develop the needed diabetes foot care skills*	2 (10.5)	15 (78.9
Develop confidence to implement recommended foot care activities*	1 (5.3)	16 (84.2)
Make diabetes care choices appropriate to promote healthy feet*	1 (5.3)	16 (84.2)
Find other information and support important to maintain healthy feet*	–	17 (89.5)
Develop the commitment vital to care for my diabetes and feet*	1 (5.3)	16 (84.2)
Address my diabetes foot-related concerns, needs or problems*	–	17 (89.5)

Note: Frequency counts of agree and strongly agree responses were merged as 'agreed' and disagree and strongly disagree as 'disagreed' because of the small number of participants.
* Represents questions with missing responses, N = 19.

4. Discussion and conclusion

4.1. Discussion

This feasibility study assessed PWD acceptance of the DFCG, their engagement in DFCG, and the efficacy of DFCG on diabetes foot care-related outcomes. Thirty-two adults with type 1 and 2 DM aged 24 to 77 years old were enrolled in the study. There is no fixed sample size in feasibility studies [30]. Despite the challenges experienced in recruiting participants due to the COVID-19 pandemic, the study sample size was adequate and within the range recommended in literature for feasibility studies [30]. The participants' education levels indicated they all had adequate literacy skills. Given the popularity of social media among persons below 50 years of age [43], it was encouraging that 93.8% of the participants were 50 to 77 years old. The findings from this study suggest that social media could be a virtual option for older adults' diabetes foot self-care education and support. The participants in our study were residents of seven Canadian provinces and one territory across four ethnic groups (White, Asian, Black, and First Nations), which reflects the ability of social media-based interventions to improve accessibility of PWD of diverse backgrounds to foot self-management programs. In addition, most participants had a moderate to high DFU risk and poor foot self-care adherence at baseline, which justified the need for this study.

Acceptability is an essential factor in the development, evaluation,

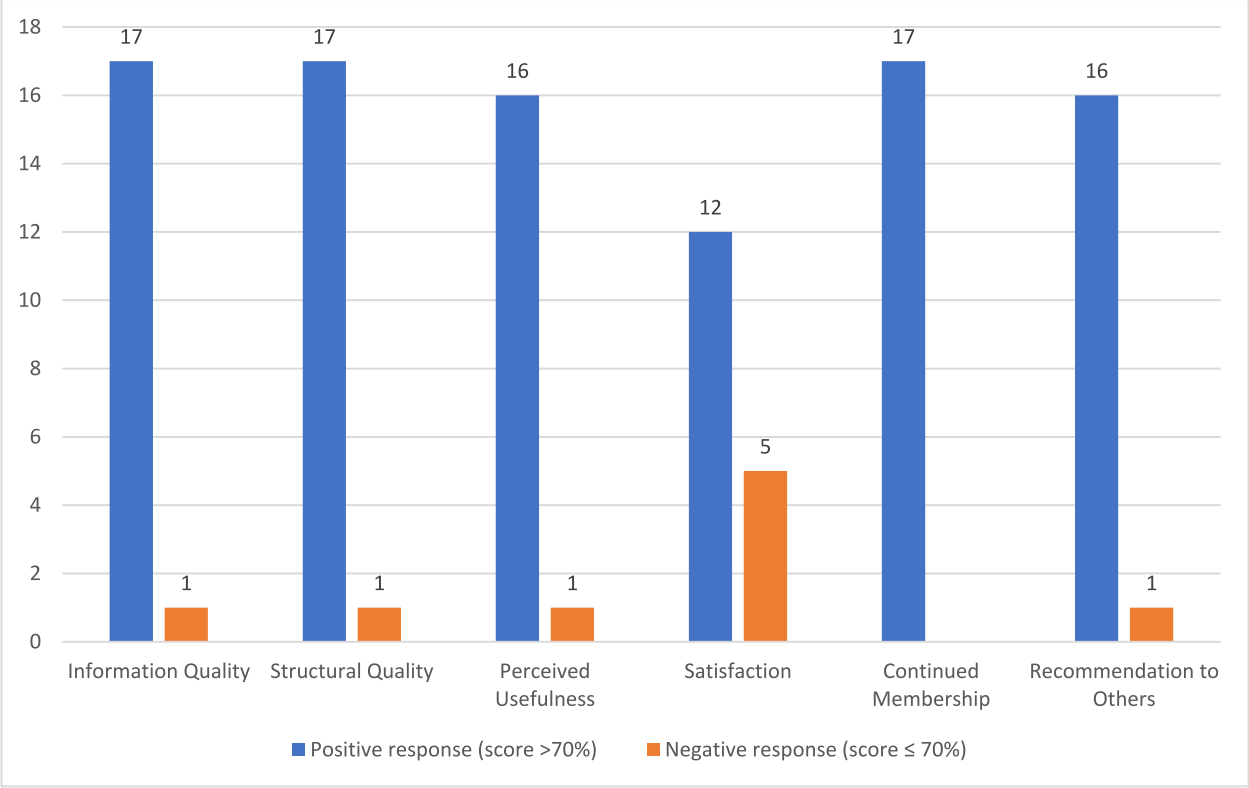

Fig. 2. Intervention acceptability components and participants' response rating.

and implementation of health programs. Acceptability assessment provides insight into the target population's perceptions and can inform future decisions [44]. In this study, the overall DFCG acceptance level was high. A high health intervention acceptance rate is associated with a high likelihood that patients will utilize or engage with intervention, which influences health outcomes in the long-term [44]. The duration of DM among the study participants who completed the acceptability survey ranged from 0 to 29 years, with 68.4% being persons diagnosed with DM for at least five years. Thus, suggesting that newly diagnosed PWD and those with diabetes for a long duration could find social media-based programs acceptable.

The second outcome of this study was engagement. Engagement was operationalized as the average weekly percentage of participants that actively immersed themselves in DFCG measured using quantitative metrics, including the number of participants who read study posts, posted, liked, commented, and responded to poll questions in DFCG. Quantitative engagement metrics are essential in providing insight into the success and value of social media-based programs [45]. The participants' engagement level in DFCG was moderate (55%). Most participants read study posts, commented, liked, and responded to poll questions. Active engagement in social media content was associated with high self-accountability and opportunity for patients with chronic diseases to become knowledgeable about their conditions [21]. The engagement level in this study could have been higher than 55%. However, due to the COVID-19 pandemic, participants could not be recruited into the study in a single pool for a simultaneous three-month follow-up. As a result, participants joined the study at different times, with about 80% completing the 3-month follow-up survey before June 2021. At the end of the study, all the members continued with their membership, another key engagement metric and reflection of participant satisfaction with DFCG that could help in future decision-making [46].

Preliminary efficacy was the final feasibility outcome assessed in this study. Participation in DFCG, in addition to usual care, led to significant improvement in participants' adherence to HCP foot self-care recommendations, foot self-care preventive practice, perceived foot health status, and physical well-being. In addition, we observed a non-significant increase in participants' self-care efficacy, communication with HCP, awareness of community resources, and reduction in potentially foot-damaging behaviours in the IG. According to IWGDF, PWD adherence to foot self-care recommendations is an important factor in DFU prevention [4]. Appropriate self-care involves diligent, consistent foot care practice. For example, PWD who engage in frequent foot examinations may help identify early signs of skin damage such that prompt modifications to physical activities and footwear can be introduced. Equally important, potentially foot-damaging activities (e.g., walking barefoot indoors, inappropriate footwear, self-treatment of corn/callus using blades) should be avoided in light of the common complications associated with DFU, including peripheral neuropathy, peripheral arterial disease, and foot deformity [36]. Inappropriate footwear is associated with foot injury due to excessive friction, and plantar pressure has been reported in the literature as a major contributor to DFU [47]. Foot-damaging practices are influenced by sociocultural values, misunderstanding, and convenience [46]. Therefore, empowering PWD to identify possible causes of foot injuries is crucial in reducing DFU risks [48]. Other self-care activities essential in promoting diabetes foot health emphasized in DFCG include improving foot circulation, foot screening by HCP, maintaining optimal blood glucose levels, and controlling co-morbid conditions [32].

Overall, DFCG had a high efficacy rate, as eight of the nine assessed diabetic foot care outcomes improved post-intervention in IG. DFCG did not lead to improvement in participants' mental health status in the IG. A randomized control trial on a health education program for engagement of older adults in optimal foot self-care behaviour also found an insignificant effect of the program on mental health status [7]. The impact of DFU on the quality of life of PWD, including mental health, is well established in the literature, however, the effect of foot self-care programs on mental health is not clear [3,49]. Thus, the preliminary

Table 4
Preliminary efficacy of DFCG on diabetes foot care-related outcomes.

variables	Time point	Independent samples t-test			
		Intervention group (n = 20)	Control group (n = 9)	t	p
		(Mean ± SD)	(Mean ± SD)		
Primary outcome					
Foot self-care adherence	T1	64.7 ± 16.1	63.6 ± 12.6	0.18	0.86
	T2	75.4 ± 14.7	59.8 ± 13.3	2.72	0.01^{+}
Preventive foot self-care practice	T1	56.4 ± 21.2	49.5 ± 16.2	0.87	0.40
	T2	72.8 ± 18.9	47.3 ± 16.0	3.53	0.002^{+}
Potentially foot-damaging behaviours*	T1	76.5 ± 18.8	83.6 ± 13.0	−1.02	0.32
	T2	79.0 ± 23.9	77.5 ± 12.3	0.18	0.86
Secondary outcome					
Foot self-care efficacy	T1	82.6 ± 12.5	79.3 ± 17.5	0.52	0.62
	T2	87.0 ± 12.4	78.3 ± 12.8	1.72	0.09
Community resources awareness	T1	74.5 ± 25.2	68.9 ± 16.2	0.61	0.55
	T2	85.5 ± 22.6	86.7 ± 10.0	−0.15	0.88
Participants' communication with HCP	T1	50.3 ± 21.7	52.6 ± 28.6	−0.24	0.82
	T2	62.3 ± 29.1	45.2 ± 29.0	1.47	0.15
Perceived foot health status	T1	51.5 ± 19.3	63.3 ± 18.0	−1.56	0.13
	T2	68.5 ± 17.9	62.2 ± 14.8	0.92	0.37
Physical health status	T1	42.8 ± 10.5	46.5 ± 8.9	−0.91	0.37
	T2	46.9 ± 9.8	45.2 ± 9.6	0.44	0.67
Mental health status	T1	45.4 ± 13.3	49.7 ± 11.3	−0.84	0.41
	T2	45.2 ± 11.0	52.2 ± 9.8	−1.64	0.11

Note: The independent samples t-test analysis involved only the data of participants who completed the study survey at both T1 and T2 (n = 29).
*T1 = baseline; T2 = 3-month post intervention; $^{+}$ = variables with significant difference; df at baseline and post-Int = 27 each; * higher score indicates low foot-damaging behaviours.*

evidence on DFCG efficacy in this study could be used to estimate effect size, power, and sample size necessary to comprehensively evaluate social media-based programs in DFU prevention.

Participants' geographical location was observed as the only included socio-demographic characteristic that had a moderate to strong relationship with all assessed outcomes. Due to the measurement of participants' location as province/territory of residence, the relationship between participants' location and diabetes foot care-related outcomes and the differences in terms of rural-urban dimension could not be determined as this was not collected. However, based on participants' comments in DFCG, there are statements suggesting that people in the rural area had challenges accessing necessary diabetes foot care resources, including HCP. In addition, the COVID-19 pandemic further worsened the participants' challenges regarding access to health resources. There is a lack of clarity on the impact of geographical location on PWD foot care-related outcomes [50,51]. Despite this limitation, access to social media could benefit PWD in rural communities if internet access is available.

A strength of this study is the selected research design. The design considered participants' preferences in allocation into the study groups, thereby increasing the study's external validity [52]. Also, outcome variables with significant improvement post-intervention had a large effect size (foot self-care adherence, preventive foot self-care practice, and physical health status). A large effect size indicates that the study findings have practical significance. In spite of the inherent strength associated with the study design with regards to the participants having the option to choose their preferred study group, we observed that the study sample was heterogeneous, which could limit the obtained result, in particular, the preliminary efficacy of DFCG. Another limitation of this study is the control group size. The size of the control group made it impossible to separately compare the outcome variables of those allocated to the control group based on preference and randomization with the intervention group, which could have helped explore the study's internal validity. All the feasibility variables were self-reported, with a potential recall bias that could have impacted the research findings. Based on the virtual nature of this study, we could not exclude recall bias and collect objective data on participants' foot conditions that could help assess the incidence of DFU. The generalizability of this study's findings is limited due to the goal of feasibility studies. Also, the long-term efficacy of DFCG on diabetes foot care outcomes was not accessed.

4.2. Innovation

DFCG is an innovative method that can substantially help HCP provide reliable information about health conditions, including diabetes-related foot health issues, in an accessible way. Social media creates more opportunities for PWD to learn at their own pace while interacting and being supported by peers, thus reducing the barriers limiting PWD participation in diabetes foot self-management education and support programs [19,46]. Social media can be an effective virtual method of engaging PWD in DFU prevention. To ensure continuing education and support of PWD as recommended by IWGDF, HCP should consider utilizing social media as an alternative method for diabetes foot self-care empowerment.

4.3. Conclusion

The study findings revealed that DFCG was acceptable and engaging and could effectively improve PWD foot care-related outcomes. Therefore, a social media-based self-management program for PWD empowerment in DFU prevention is feasible. However, given the scope of this study, more confirmative studies, such as randomized control trials, are needed. Future studies should include a larger and more diverse sample size with longer follow-up duration and collection of objective data that include foot examination to validate the impact of social media-based interventions on patient outcomes, especially the incidence of DFU.

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CRediT authorship contribution statement

Helen Ngozichukwuka Obilor: Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Olena Veryha:** Project administration, Conceptualization. **Tom Weisz:** Project administration, Conceptualization. **Mariam Botros:** Project administration, Conceptualization. **Rosemary Wilson:** Writing – review & editing, Visualization, Supervision, Conceptualization. **Joan Tranmer:** Writing – review & editing, Visualization, Supervision, Conceptualization.

Table 5
Multivariate analysis of covariance for the controlled effect of study programs on diabetes foot care-related outcomes.

Outcome variables at T2	Covariates*		F value	df	df error	*p*	η_p^2
	Participants' characteristics with a significant relationship	r / η					
Primary outcome							
Foot self-care adherence	Province of residence	0.53^{η}	13.53	1	25	0.001^{+}	0.35
Preventive foot self-care practice	Province of residence	0.57^{η}	12.22	1	25	0.002^{+}	0.33
Potentially foot-damaging behaviours	Province of residence	0.71^{η}	3.20	1	25	0.09	0.11
Secondary outcome							
Foot self-care efficacy	Education	0.42^{η}	2.45	1	24	0.13	0.09
	Province of residence	0.56^{η}					
Community resources awareness	Province of residence	0.53^{η}	0.23	1	25	0.63	0.01
Participants' communication with HCP	Depression	0.42^{r}	3.40	1	21	0.08	0.14
	DFU risk level	0.35^{η}					
	Ethnicity	0.36^{η}					
	Living arrangement	0.36^{η}					
	Province of residence	0.51^{η}					
Perceived foot health status	Education	0.45^{η}	1.49	1	24	0.24	0.06
	Province of residence	0.51^{η}					
Physical health status	DFU risk level	0.38^{η}	6.43	1	21	0.02^{+}	0.23
	Duration of DM	-0.45^{r}					
	Education	0.38^{η}					
	Ethnicity	0.39^{η}					
	Province of residence	0.52^{η}					
Mental health status	Province of residence	0.46^{η}	2.28	1	25	0.14	0.08

Note: Statistical test entailed Analysis of Covariance.
Study programs are DFCG vs. usual care.
* represents covariates that comprised each corresponding T1 diabetes foot care-related outcome score in addition to the participants' characteristics with significant/moderate correlation (listed).
r = Pearson's correlation coefficient, ^{r} = Pearson correlation coefficient is significant at the 0.05, η = Eta correlation, $^{\eta}$ = Eta correlation value with a moderate effect size, $^{+}$ = Outcome variable with significant effect after controlling for covariates, η_p^2 = partial eta squared, T1 = baseline, T2 = at three-month post-intervention.

Kevin Woo: Writing – review & editing, Visualization, Validation, Supervision, Conceptualization.

Declaration of competing interest

The authors declare that they have no affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter discussed in this manuscript.

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