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Original Research

Optimization of Care for Adult Outpatients With Type 2 Diabetes Through the Diabetes Self-Management Multidisciplinary Program: A Randomized Clinical Trial

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Key Messages

- Diabetes self-management can improve glycemic management and quality of life, but promoting self-management strategies remains a major challenge.
- A diabetes self-management multidisciplinary program was designed tailored to the local culture and habits of a low-income, low-education population with type 2 diabetes.
- This short-term program improved quality of life of individuals with longstanding type 2 diabetes.

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ABSTRACT

Objectives: Our aim in this study was to evaluate the efficacy of a Self-Management Multidisciplinary Program (MP) on glycemic management, quality of life and diabetes self-care activities.
Methods: People with type 2 diabetes and glycated hemoglobin (A1C) of >7.5% were randomized to participate in the MP or to usual care (UC). The MP consisted of face-to-face meetings with each health-care provider (nurse, pharmacist, dietitian, physical educator and social worker) to approach diabetes self-management issues. MP topics were tailored toward local habits and culture. Three different modules were offered over 12 weeks. The primary outcome was change in A1C from baseline to 12 months. Diabetes Quality of Life and Summary of Diabetes Self-Care Activities questionnaires were assessed at baseline and at 6 and 12 months.
Results: Ninety-six participants were included (mean 59 years of age, 60% women, diabetes duration 16±10 years, 62% of lower middle/low socioeconomic status). Change in A1C at 12 months (UC: 0.52% [95% confidence interval, −1.07 to 0.04]; MP: −0.30% [95% confidence interval, −1.05 to 0.44]; p=0.33) was not different between the groups. There was an increase in satisfaction and a reduction in worry about future effects of diabetes in the MP group, which was not found in the UC group.
Conclusions: A short-term self-management multidisciplinary program improved diabetes-related quality of life but failed to reduce A1C in individuals with longstanding type 2 diabetes and a low socioeconomic status.

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RÉSUMÉ

Objectifs : L'objectif de notre étude était d'évaluer l'efficacité d'un programme multidisciplinaire (PM) sur la prise en charge autonome sur la régulation de la glycémie, la qualité de vie et les activités d'auto-soins du diabète.
Méthodes : Nous avons réparti les personnes atteintes du diabète de type 2 qui ont une hémoglobine glyquée (A1c) de > 7,5 % au groupe du PM ou au groupe des soins courants (SC). Le PM prenait la forme de rencontres en personne avec chacun des professionnels de la santé (infirmier, pharmacien, diététicien, éducateur physique et travailleur social) pour aborder les questions liées à la prise en charge autonome du diabète. Les thèmes du PM étaient adaptés à la culture et aux habitudes locales. Trois modules différents étaient offerts pendant 12 semaines. Le principal critère d'évaluation était la variation de l'A1c du début au 12^{e} mois. Les questionnaires Diabetes Quality of Life et Summary of Diabetes Self-Care Activities étaient évalués au début, après 6 mois et après 12 mois.
Résultats : Nous avons retenu 96 participants (âge moyen de 59 ans, 60 % de femmes, durée du diabète de 16 ± 10 ans, 62 % de statut socioéconomique de catégorie moyenne inférieure/faible). La variation de l'A1c après 12 mois (SC : 0,52 % [intervalle de confiance à 95 % de −1,07 à 0,04]; PM : −0,30 % [intervalle de confiance à 95 % de −1,05 à 0,44]; p = 0,33) n'était pas différente entre les groupes. Au sein du groupe du PM, mais non au sein du groupe des SC, nous avons observé une augmentation de la satisfaction et une diminution de l'inquiétude sur les répercussions futures du diabète.
Conclusions : Un programme multidisciplinaire à court terme sur la prise en charge autonome du diabète a contribué à l'amélioration de la qualité de vie liée au diabète, mais n'a pas permis de réduire l'A1c chez les individus atteints d'un diabète de type 2 de longue date et ayant un statut socioéconomique faible.

Introduction

Type 2 diabetes is a chronic disease characterized by hyperglycemia, and is associated with vascular comorbidities and a high mortality rate (1). Despite pharmacologic advances over the past 2 decades (2,3), it is estimated that 33% of people with diabetes have glycated hemoglobin (A1C) levels above individualized target (4). Diabetes management goes beyond taking medication. It involves complex health behaviour changes and engagement in routine self-care activities, including food choices, physical activity, blood glucose checks, foot examination and insulin administration, among others. The adoption of these measures associated with the concern about possible complications arising from diabetes results in a daily burden for individuals and their families (5), evidenced by reduced quality of life (6). For global management of diabetes, individuals need knowledge, training and support from health-care providers to be able to maintain long-term care (7).

Diabetes self-management education and support (DSMES) has proven to be an excellent option for glycemic management and improved quality of life (8,9). The main goal of diabetes DSMES is to provide knowledge and skills necessary for informed decision-making, enhancing individuals' autonomy and empowerment (8,10). There are several forms of DSMES, which must be adjusted to the sociocultural context of the population of interest.

DSMES delivered by a multidisciplinary team were associated with a decrease in A1C when compared with DSMES delivered by a single provider (11,12). The health-care professionals most commonly involved in team-based programs are nurses (13–15), dietitians (13,14) and pharmacists (16). Others providers (physical educator, social worker, mental health specialists) may also assist the needs of people with diabetes (8,10).

Although important, promoting self-management strategies remains a major challenge (17), especially in low- and middle-income countries, where social determinants could impact more strongly on health (18).

The current trial was therefore designed to investigate the effect of a face-to-face, short-term self-management multidisciplinary program on glycemic management in outpatients with type 2 diabetes at a public hospital in a middle-income country.

Methods

Study design

This was a single-centre, open-label, parallel-group, randomized (1:1) clinical trial, with blinded primary outcome assessors. Individuals ≥18 years of age with type 2 diabetes, who were seen at the diabetes outpatient clinic of a tertiary public hospital from southern Brazil in the previous 12 months, were randomly invited to participate in the study by personal or telephone contact. The study was approved by the institution's research ethics committee (Protocol No. CAEE 62484316.3.0000.5327), and written informed consent was obtained from each participant before enrolment. The trial was registered in ClinicalTrials.gov (NCT03074383) and was reported according to the CONSORT statement (19).

Participants

Eligible participants were all adults ≥18 years of age with a diagnosis of diabetes, under outpatient follow-up with an endocrinologist in a tertiary hospital and A1C of >7.5% (>58 mmol/mol). Exclusion criteria were diabetes other than type 2; neurologic, psychiatric or cognitive deficits that could prevent adequate understanding or participation in the program; and participation in another randomized clinical trial in the past 3 months.

Interventions

The intervention group participated in the Diabetes Self-Management Multidisciplinary Program (MP), consisting of 3 face-to-face meetings, with an interval of 4±2 weeks between them. The program consisted of brief individual meetings with health professionals in which different topics were addressed to optimize diabetes self-management. At each meeting, the participant was guided through 5 multidisciplinary stations with the

following health-care providers: dietitian, nurse, pharmacist, physical educator and social worker. In each station, the health-care provider individually met with each participant for 15 minutes. Five participants were seen simultaneously within the same room in a rotation system, until all of them inside the room had been seen by all health professionals (see Supplementary Methods and Supplementary Figure 1). The topics addressed at each station at each meeting are described in the Supplementary Methods. The health professionals were previously trained, and the Diabetes Self-Management MP model was applied in clinic for 3 months before the start of the trial. Printed educational materials on diabetes (booklet, identification card and fridge magnet) addressing topics that corresponded to those addressed in the program were provided for all individuals. One coordinator managed the meeting and all professionals gathered together at the end, annotating their assessment and plans on the electronic records.

Participants allocated to the usual care (UC) group met with the research team on 3 different occasions, with an interval of 4±2 weeks between them, to receive the same educational material that the MP group received. These brief (5 to 10 minutes) meetings were planned as a control for the meetings held by the MP group, as the mere fact of receiving professional attention alone can improve some health outcomes (20). At the end of the trial, participants in the UC group were invited to participate in the program.

Participants in both groups maintained routine follow-up visits with their physicians, who were allowed to modify the treatment to achieve the glycemic target if necessary.

The development of the program and the content addressed, both personally and by educational materials, were tailored to the local culture and habits of the low-income, low-education population. We used simple language to motivate engagement in self-care activities in a nonjudgmental way. We chose this approach to create a bond of trust with participants to empower and help them learn how to manage their own disease. Both the program and meetings were held at the hospital that serves through the public health system.

Outcomes

The primary outcome was change in A1C level from study entry to 12 months. Secondary outcomes were percentage of participants reaching an A1C of ≤7.5% (58 mmol/mol) and ≤8.0% (64 mmol/mol); scores on the Diabetes Quality of Life questionnaire (21), Summary of Diabetes Self-Care Activities (SDSCA) questionnaire (22) and International Physical Activity Questionnaire (IPAQ) (23); body weight variation; blood pressure; and lipid profile (total cholesterol, high-density lipoprotein cholesterol and triglycerides). The 3 questionnaires are used in clinical and research settings worldwide and have been cross-culturally adapted and validated for Brazilian Portuguese (24).

The Diabetes Quality of Life questionnaire consists of 4 domains (satisfaction, impact, social/vocational worries and diabetes-related worries) with answers scored from 1 to 5. Lower scores indicate higher quality of life. The “social/vocational worries” domain was excluded because most of our participants were retired or inactive.

The SDSCA questionnaire assesses the number of days, over the previous 7 days, on which respondents engaged in several diabetes self-care activities. The closer to 7 days, the better the engagement to self-care items. The revised scoring system was applied by grouping the responses for general diet, foot care, blood glucose testing and exercise (25).

The IPAQ was applied using the following domains: transport-related physical activity, domestic and gardening activities and leisure time physical activity. Scores were calculated for each domain using the number of minutes of physical activity in the previous 7 days and the mean number of hours spent sitting per day.

All participants collected blood for A1C, completed the questionnaires and had their weight and blood pressure measured at baseline and at 6 and 12 months after study entry. Lipid profile was measured at baseline and at 12 months (Supplementary Figure 2).

Socioeconomic status was assessed by the Brazilian Criteria 2015 and Social Class Distribution Update (26).

Randomization

Treatment assignment was determined by computer-generated simple random sequencing using SAS version 9.4 (SAS Institute, Inc, Cary, North Carolina, United States) and kept sealed until the participant was allocated to the treatment group. Both investigators who generated and managed the randomization list did not participate in the screening or allocation. Due to the nature of the interventions, blinding of the participants and research staff was not possible. However, the assessor remained blind to participants' treatment allocation.

Statistical analysis

Based on a previous study (27), to detect a difference in A1C values of moderate effect size between the groups, with a power of 80% and a significance level of 0.05, a total sample size of 80 participants was necessary. Given an anticipated dropout rate of approximately 20%, the recruitment target was increased to 96 participants to compensate for possible losses. Data were expressed as mean ± standard deviation, number (%) or median (interquartile range). For between-group comparisons, Student's t test was used for quantitative variables and the chi-square test was used for categorical variables. Generalized estimating equations for repeated measures analysis with Bonferroni's correction were used to assess the effect of the intervention on changes in the primary and secondary outcomes from baseline to 12 months, following the intention-to-treat principle. Primary outcome analyses were adjusted for baseline A1C. All analyses were performed using SPSS version 20 (IBM Corp, Armonk, New York, United States).

Results

Participants' characteristics

A review of electronic medical records showed that 637 people had been seen at the endocrinology outpatient clinic in the previous year. Of these, 479 were excluded for the following reasons: 359 did not meet the inclusion criteria, 61 did not answer telephone calls and 11 failed to attend the first visit; 48 were eligible but not contacted (Figure 1). Of the 158 eligible individuals with type 2 diabetes who were successfully contacted, 62 declined to participate in the study, resulting in 96 participants who were randomly assigned to UC (n=48) or MP (n=48) groups. Recruitment started in March 2017 and ended in January 2018. Follow-up was completed in March 2019. One participant in the MP group dropped out of the study shortly after randomization. Four participants died during the study: 3 in the UC group (1 due to sepsis after cancer surgery, 1 sepsis associated with necrotizing fasciitis and 1 unknown cause) and 1 in the MP group (stroke); none of the deaths were directly related to the study procedures.

The participants' clinical and laboratory characteristics are shown in Table 1. The sample consisted mostly of women (60%), 59±9 years old and diabetes duration of 16±10 years. Most participants (62%) belonged to the lower middle socioeconomic class. No differences were observed among groups, except for a nonstatistical higher number of women in the UC group.

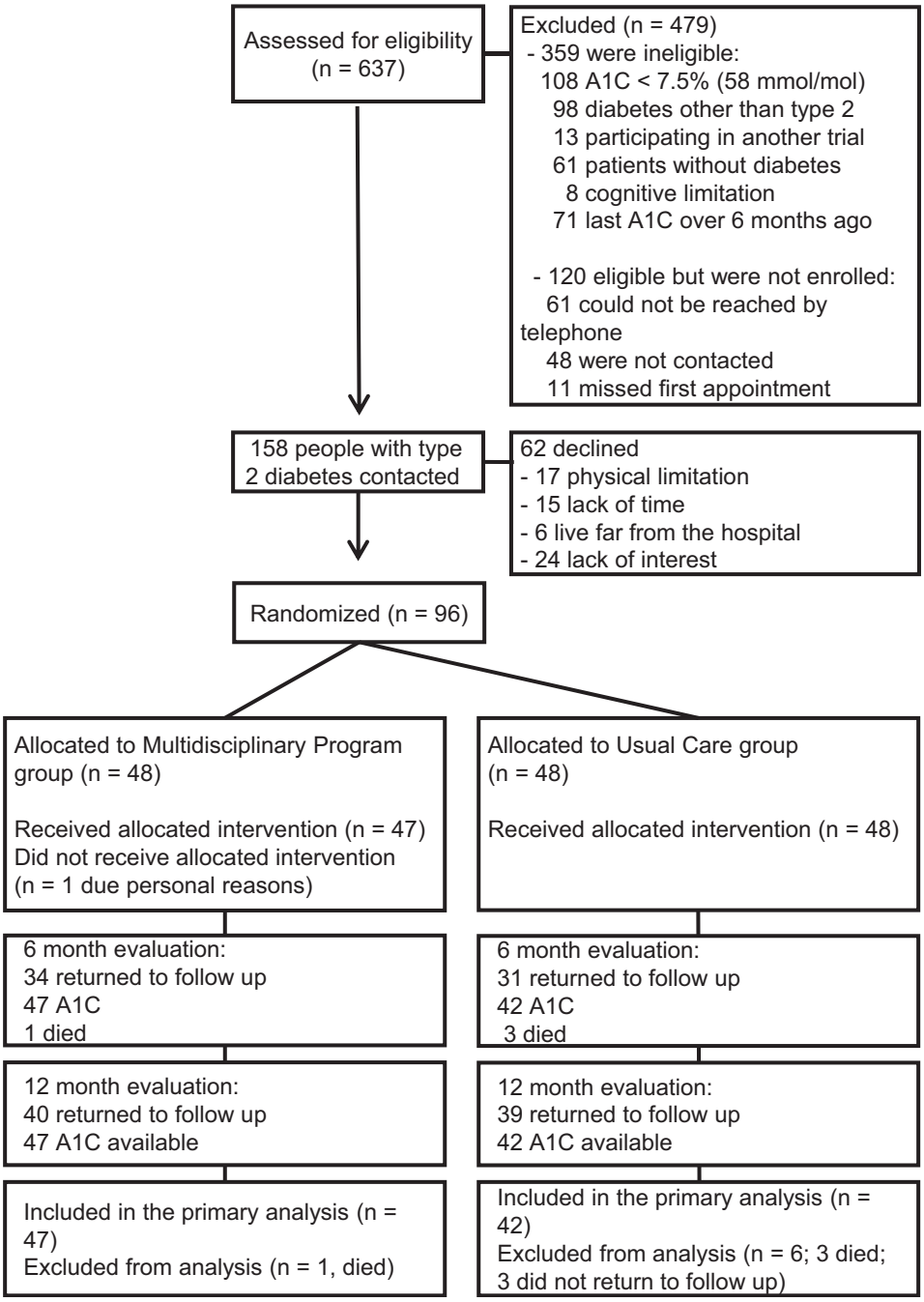

Figure 1. Participant flow diagram during the 12-month period. *A1C*, glycated hemoglobin.

Attendance rate

High attendance was recorded in the meetings with the research team for both the UC group (>93%) and the MP group (>95%).

Primary outcome measure

In both groups, A1C at 12 months did not differ from baseline: UC delta (Δ) −0.52% (95% confidence interval [CI] −1.07 to 0.04, p=0.08) vs MP Δ −0.30% (95% CI −1.05 to 0.44, p=1.00), nor between the groups (p=0.33) (Supplementary Table 1 and Supplementary Figure 3). At 6 months, the UC group showed a decrease in A1C (Δ −0.56% [95% CI −1.04 to −0.08], p=0.02) from baseline, which was not shown at the end of follow-up. At the end of 12 months, only 8 (16.7%) participants in the UC group and 5 (10.4%) in the MP group achieved an A1C of ≤7.5% (58 mmol/mol; p=0.369); 14 (33.3%) participants in the UC group and 10 (21.3%) in the MP group achieved an A1C of ≤8.0% (64 mmol/mol; p=0.203).

Change in weight, blood pressure and lipids

There was no change in weight or blood pressure and no improvement in the lipid profile during follow-up in any of the groups (Supplementary Table 2).

Table 1
Baseline clinical and laboratory characteristics

Characteristics	UC (n=48)	MP (n=48)
Age, years	60±9	59±9
Female sex	24 (50)	34 (71)
White race	12 (75)	19 (60)
Education time, years	7±3	7±4
Income ≤2 minimum wages [‡]	24 (51)	20 (43)
Medium–low/low socioeconomic status	30 (63)	30 (63)
Duration of diabetes, years	16±10	16±10
Comorbities, n (%)		
Obesity	32 (67)	32 (67)
Hypertension	43 (92)	46 (96)
Coronary artery disease	28 (58)	18 (39)
Stroke	9 (19)	6 (13)
eGFR <60 mL/min/1.73 m^2	16 (33)	10 (21)
Lower limb amputation	2 (4)	3 (6)
SBP, mmHg	140±20	134±19
DBP, mmHg	76±9	78±12
Medication, n (%)		
Metformin	37 (77)	41 (85)
Sulfonylurea	12 (26)	14 (29)
SGLT2 inhibitors	0 (0)	4 (8.3)
Basal insulin [*]	40 (83)	40 (83)
Bolus insulin [†]	19 (40)	19 (40)
Aspirin	33 (69)	28 (58)
Statin	44 (92)	39 (85)
ACE inhibitors/ARBs	43 (90)	40 (85)
Laboratory tests		
A1C, %	9.5±1.2	9.9±1.5
A1C, mmol/mol	80±13	84±15
Total cholesterol, mg/dL	171±45	169±43
HDL-C, mg/dL	43±13	45±13
LDL-C, mg/dL	93±42	89±35
Triglycerides, mg/dL	180±83	195±86

A1C, glycated hemoglobin; *ACE*, angiotensin-converting enzyme; *ARB*, angiotensin II receptor blocker; *DBP*, diastolic blood pressure; *eGFR*, estimated glomerular filtration rate; *HDL-C*, high-density lipoprotein cholesterol; *LDL-C*, low-density lipoprotein cholesterol; *MP*, multidisciplinary program; *SBP*, systolic blood pressure; *SGLT2*, sodium-glucose cotransporter-2; *UC*, usual care.
Note: Data expressed as median ± standard deviation or as number (%).
[*] Three participants (2 in UC group and 1 in MP group) were using insulin glargine. The others were using NPH insulin.
[†] One participant in the intervention group used insulin lispro. The others used regular insulin.
[‡] Equivalent to a monthly income of ≤US $400/month.

Quality of life

The MP group reported increased satisfaction associated with diabetes (Δ −0.28 [95% CI −0.55 to −0.02], p=0.034) and decreased worry about future effects of diabetes (Δ −0.46 [95% CI −0.79 to −0.12], p=0.003) at 12 months after randomization, a trend not found in the UC group in the same period (Δ −0.12 [95% CI −0.35 to 0.11], p=0.64; Δ 0.09 [95% CI −0.24 to 0.42], p=1.0) (Figure 2B and C). Overall, there was an improvement in quality of life in the MP group at 12 months after randomization: Δ −0.23 (95% CI −0.45 to −0.01, p=0.04) (Figure 2A). There was no change in scores in the domain of impact associated with diabetes.

Diabetes self-care activities

Among the self-care items assessed by the SDSCA questionnaire, an improvement was observed in foot care in both groups, as evidenced by an increase in the number of days per week on which foot care was performed: from 4.0 (95% CI 3.3 to 4.7) days at baseline to 4.8 (95% CI 4.1 to 5.5) days at 12 months (p=0.04) in the UC group, and from 3.8 (95% CI 3.1 to 4.5) days to 5.1 (95% CI 4.4 to 5.8) days at 12 months (p<0.001) in the MP group. At baseline, the MP group showed a dietary pattern of less fat consumption than the UC group: 2.3 (95% CI 1.5 to 3.0) days without consumption of high-fat foods in the UC group vs 3.6 (95% CI 3.0 to 4.3) days in the MP group (p=0.005) (Table 2). At 6 months, the MP group showed a trend toward a better general dietary pattern when compared with the UC group (4.8 [95% CI 4.2 to 5.5] days vs 3.7 [95% CI 2.8 to 4.6] days; p=0.053), but this difference lost significance during follow-up. Both groups reported low engagement in physical activity (UC: 0.9 [95% CI 0.4 to 1.3] days; MP: 1.6 [95% CI 1.0 to 2.2] days; p=0.05 between groups). Although the MP group performed more physical activity at the beginning and at 6 months, this difference was not found at the end of follow-up (p=0.45).

Physical activity

Confirming the findings of the SDSCA questionnaire, both groups had a high rate of physical inactivity. Only 8 (17%) and 18 (38%) participants in the UC and MP groups, respectively, reported exercising for >10 minutes continuously during the week (p=0.38). During the 12-month follow-up, the number of minutes of physical activity did not differ from baseline values (p=1.0 in both groups), and there was also no difference between the groups (p=0.12). During follow-up, the UC group had more sedentary time than the MP group at 6 months (8.5 [95% CI 7.4 to 9.5] hours/day vs 6.6 [95% CI 5.3 to 7.8] hours/day, p=0.03) and at 12 months (8.9 [95% CI 7.6 to 10.2] hours/day vs 6.30 [95% CI 5.2 to 7.4] hours/day, p=0.003).

Adverse effects

Participants reported minimal adverse effects related to the study procedures, such as pain or discomfort with blood collection (2 in the MP group and 5 in the UC group) and bruising at the puncture site (4 in the MP group and 7 in the UC group).

Discussion

The Diabetes Self-Management MP was developed to provide brief individual assistance for participants with diabetes through a multidisciplinary approach with the objective of improving glycemic management by encouraging diabetes-related self-care activities.

A systematic review comprising 118 randomized clinical trials showed that the reduction in A1C is greater in DSMES interventions performed with a contact time of >10 hours (11). Although the contact time in our study was around 4 hours, the program design was enough to improve participants' quality of life and foot care.

The reduction in A1C did not reach statistical significance at 12 months from baseline (approximately 9 months after the intervention). This result appears to be consistent with the basic principles of the educational process, in which repetition of information is necessary (28). Likewise, health behaviour changes follow the same pattern, where strengthening of guidance and monitoring by the researchers serve to consolidate the information acquired. Other factors, such as high body mass index, presence of comorbidities, low education level, financial distress and a more negative illness perception, are associated with poor activation for behavioural change (29). It has also been shown that, even when recruiting people who are willing to undergo intensive health behaviour changes, intervention effects are lost over time (30).

Unlike previous studies showing improvement in A1C after DSMES interventions (31), our study enrolled individuals seen at a specialized tertiary care outpatient clinic who had longstanding disease and were receiving a complex insulin plan (80% were receiving basal insulin combined with regular insulin), with multiple comorbidities and serious complications associated with diabetes. In a study with an individual approach carried out by a multidisciplinary team, it showed that nonresponders were those with poor compliance, serious comorbidities and limitation of mobility (32). Other studies that allocated participants with a higher A1C and a higher proportion of insulin users also did not

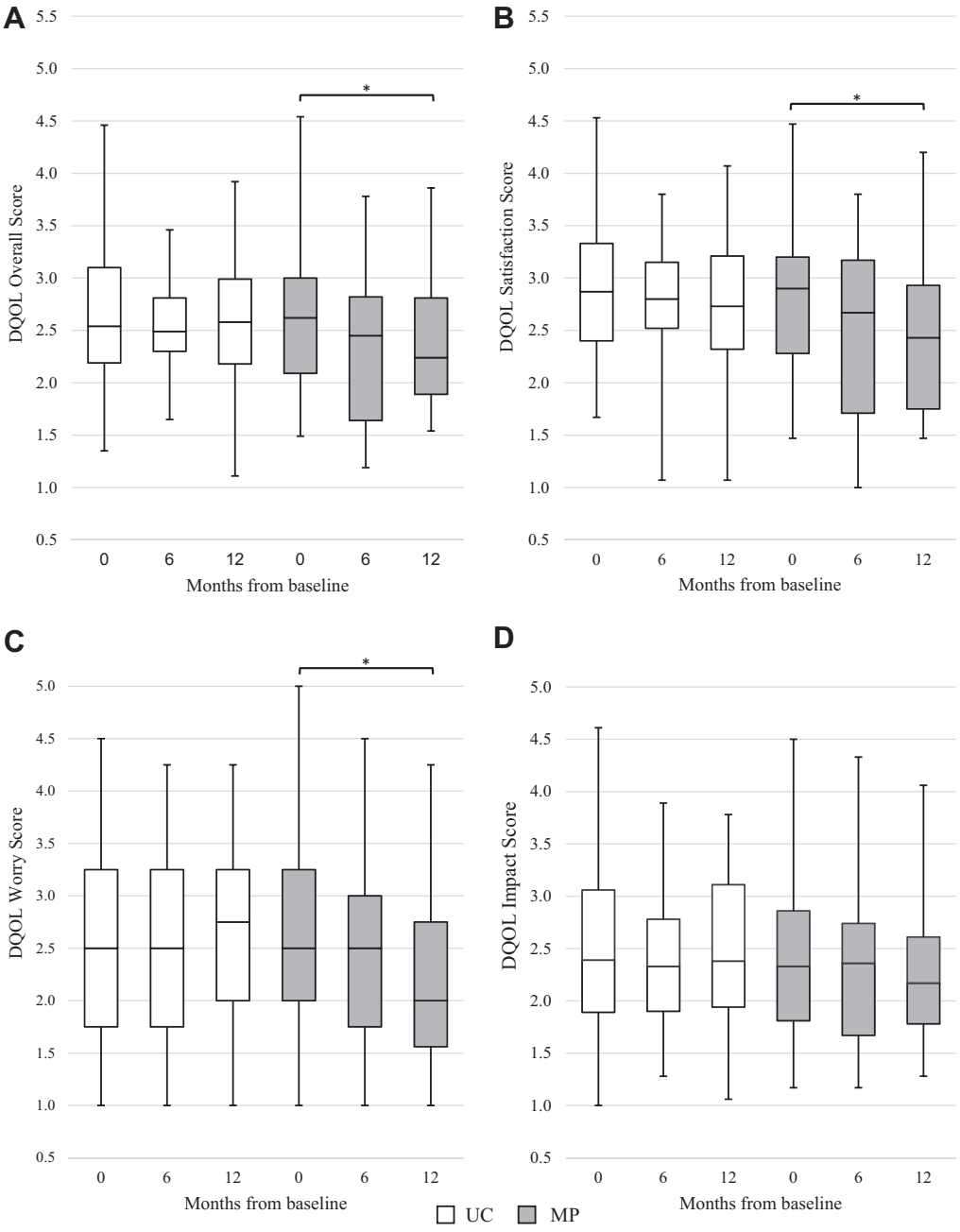

Figure 2. Diabetes Quality of Life Questionnaire (DQOL) score change at 6 and 12 months from baseline. DQOL scores range from 1 to 5. Higher value means poorer quality of life in each separate domain and overall score. There was a significant improvement in the overall quality of life (A), satisfaction (B) and worry (C) about future effects of diabetes domains in the MP group after 12 months, but not in the UC group. There was no change in the impact (D) domain. *MP*, multidisciplinary program; *UC*, usual care. * $p<0.05$.

demonstrate maintenance of the glycemic benefit months after the end of the intervention (33,34).

The UC group received printed materials, similar to those of the MP group, addressing the same topics of self-management education, including dietary guidance, importance of physical activity and correct insulin administration. It is possible that following the recommendations in the printed material and the frequent meetings with the researchers may have contributed to the initial reduction in A1C levels, thus reducing the difference in effect between the groups.

There was no increase in physical activity during follow-up. Due to previously known ischemic comorbidities (39% with coronary artery disease and 13% with stroke) and symptoms compatible with angina reported during participation in the program, the team recommended proper clinical investigation for risk stratification before encouraging physical activity (35). This may have delayed the start of physical activity and reduced the interest of some participants (36).

Our study has the differential advantage of being a pragmatic randomized clinical trial, with the development of a low-cost multidisciplinary intervention culturally directed to the target population of unmotivated individuals with multiple comorbidities and longstanding diabetes. Because real-life studies include a more representative sample in clinical practice and cause minor changes in the already established routine activities, they represent the real-world efficacy of interventions, producing results that can be more easily applied and generalized (37). Despite not reaching the primary outcome, the multidisciplinary team decided to maintain the diabetes MP for longer time than previously planned after the end of this trial because of their personal enthusiasm with the

Table 2
Change in self-care activities at 6 and 12 months from baseline

	Usual care group				Multidisciplinary program group				p Value †
	Mean (SE)	Δ	95% CI	p Value *	Mean (SE)	Δ	95% CI	p Value *	
General diet ‡									
Baseline	3.89 (0.4)	–	–	–	4.39 (0.4)	–	–	–	0.34
6 months	3.70 (0.5)	−0.19	−1.32 to 0.95	1.0	4.84 (0.4)	0.45	−0.30 to 1.19	0.44	0.05
12 months	3.75 (0.4)	−0.13	−1.19 to 0.93	1.0	4.25 (0.4)	−0.14	−0.96 to 0.68	1.0	0.35
Eat high-fat food §									
Baseline	2.25 (0.4)	–	–	–	3.64 (0.3)	–	–	–	<0.01
6 months	2.09 (0.4)	−0.16	−1.23 to 0.92	1.0	3.78 (0.4)	0.14	−0.97 to 1.26	1.0	<0.01
12 months	2.02 (0.4)	−0.23	−1.32 to 0.86	1.0	3.38 (0.4)	−0.26	−1.20 to 0.68	1.0	0.02 *
Fruit and vegetable intake ‖									
Baseline	2.31 (0.4)	–	–	–	2.88 (0.4)	–	–	–	0.35
6 months	2.94 (0.6)	0.63	−0.76 to 2.02	0.83	3.48 (0.5)	0.60	−0.99 to 2.19	1.0	0.49
12 months	1.96 (0.4)	−0.35	−1.52 to 0.82	1.0	2.76 (0.5)	-0.12	−1.55 to 1.31	1.0	0.22
Blood glucose testing ¶									
Baseline	3.30 (0.4)	–	–	–	3.84 (0.5)	–	–	–	0.38
6 months	3.38 (0.5)	0.08	−1.06 to 1.23	1.0	3.46 (0.6)	−0.39	−1.60 to 0.83	1.0	0.92
12 months	2.76 (0.5)	−0.54	−1.53 to 0.46	0.59	3.65 (0.4)	−0.19	−1.35 to 0.96	1.0	0.17
Physical activity #									
Baseline	0.86 (0.2)	–	–	–	1.63 (0.3)	–	–	–	0.05
6 months	1.36 (0.4)	0.50	−0.45 to 1.45	0.62	2.54 (0.3)	0.91	−0.08 to 1.90	0.08	0.02
12 months	1.30 (0.3)	0.44	−0.34 to 1.21	0.53	1.63 (0.3)	0.0	−0.97 to 0.97	1.0	0.45
Foot care **									
Baseline	4.02 (0.4)	–	–	–	3.79 (0.4)	–	–	–	0.64
6 months	4.06 (0.4)	0.04	−1.10 to 1.17	1.0	5.29 (0.3)	1.51	0.62 to 2.39	<0.01	0.02
12 months	4.80 (0.4)	0.78	0.02 to 1.54	0.04	5.10 (0.4)	1.31	0.43 to 2.19	<0.01	0.55

CI, confidence interval; *SE*, standard error.
Note: Data were obtained from an intention-to-treat analysis.
Summary of Diabetes Self-Care Activities questionnaire questions asked:
* Within-group difference from baseline to 6 and 12 months.
† Between-group difference in each time period.
‡ "On how many of the last 7 days have you followed a healthy diet for diabetes?" and "…have you followed an eating plan for diabetes?"
§ "On how many of the last 7 days did you *not* eat high-fat foods such as red meat or full-fat dairy products?"
‖ "On how many of the last 7 days did you eat 5 or more servings of fruits and vegetables?"
¶ "On how many of the last 7 days did you test your blood sugar?" and "…did you test your blood sugar the number of times recommended by your health-care provider?"
# "On how many of the last 7 days did you participate in at least 30 minutes of physical activity?" and "…did you participate in a specific exercise session (such as swimming, walking, biking)?"
** "On how many of the last 7 days did you check your feet?" and "…did you inspect the inside of your shoes?"

individual results and also because participants continued to report they were very grateful for the initiative.

Nevertheless, some limitations need to be addressed. Due to the nature of the proposed intervention, blinding of the participants was not possible. Participants may have informed the attending physician of the intervention, which could have induced the physician not to change doses or include medications in the current treatment plan, thus contributing to treatment inertia. Secondary outcomes were based on data from self-report questionnaires that may suffer from recall bias. Regarding the IPAQ, previous studies have reported a poor association between the questionnaire results and objective data, such as pedometer and accelerometer data (38,39), and a tendency to overestimate the time spent in physical activity (40). Conversely, another study showed no significant difference between self-reported physical activity and that measured by an accelerometer in people with diabetes (41).

Treatment of diabetes is complex and requires engagement in daily tasks. Therefore, self-management of the disease is essential to achieve control and to prevent complications (42). Short-term interventions have little effect on the achievement of long-term glycemic management (17), and the benefits of the intervention are reduced when measured a few months after its completion (43). In addition to the benefits achieved, increasing the number of meetings throughout the year could be beneficial to keep individuals motivated and engaged in the recommended care.

In conclusion, a short-term multidisciplinary program was able to improve diabetes-related foot care and quality of life but was insufficient to improve A1C in individuals with longstanding diabetes attending a public hospital in a middle-income country.

Supplementary Material

To access the supplementary material accompanying this article, visit the online version of the *Canadian Journal of Diabetes* at www.canadianjournalofdiabetes.com.

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Author Contributions

S.P.G. was responsible for conceptualization, methodology, formal analysis, investigation, data curation, visualization and writing (original draft, review and editing). M.M.M. and L.G.B. collected resources and provided data curation and writing (review and editing). L.E.R.C.M., K.S., J.S., G.B., C.B. and A.N.G. participated in conceptualization, investigation and writing (review and editing). G.H.T. participated in conceptualization, methodologic development, formal analysis and writing (review and editing). B.D.S. provided conceptualization, methodology, formal analysis, resources, writing (review and editing), supervision, project administration and funding acquisition.

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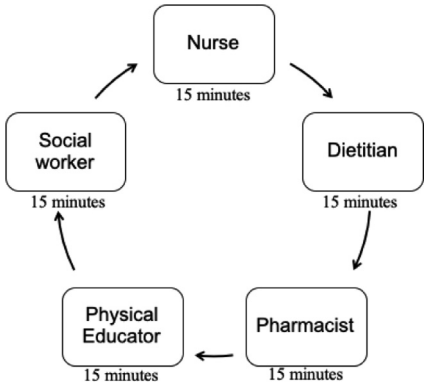
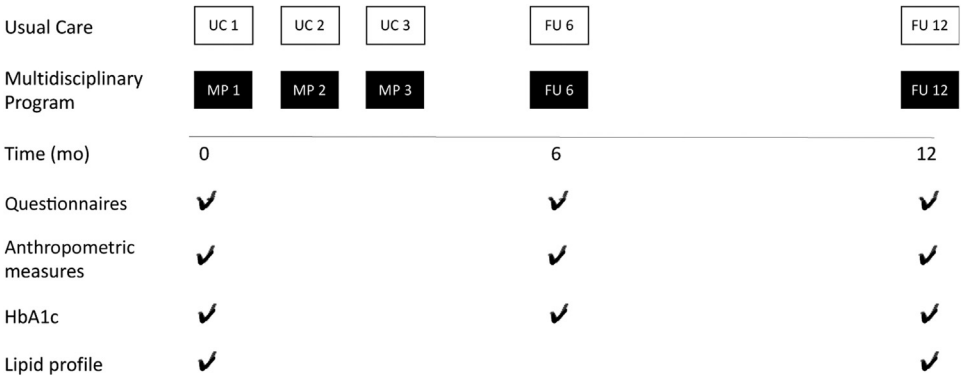
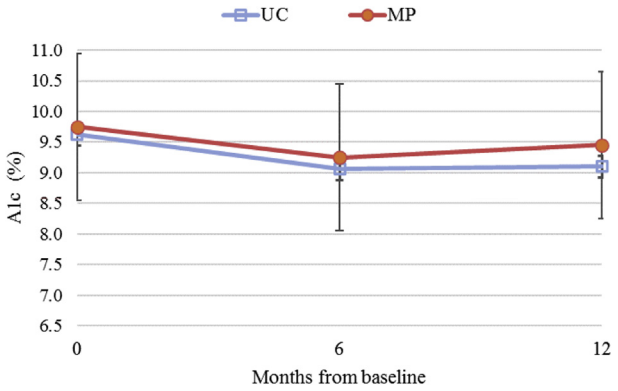


Supplementary Figure 1. Participant care flowchart for the Diabetes Self-Management Multidisciplinary Program modules. After a meeting with the researchers, each participant was seen individually by each of the 5 health professionals. After a 15-minute session in the first station, the participant moved to the next station to receive information from the next health professional, and so on until all 5 stations had been covered.



Supplementary Figure 2. Assessments performed during follow-up. Participants in the UC group met with the research team to receive printed material, whereas the participants in the MP group met with health professionals on 3 different occasions, with an interval of 4 weeks between visits. Next, participants returned to attend FU visits at 6 and 12 months for questionnaire completion, anthropometric measurements and blood collection. *FU*, follow-up; *mo*, months; *HbA1c*, glycated hemoglobin; *MP*, multidisciplinary program; *UC*, usual care.



Supplementary Figure 3. Change in glycated hemoglobin (A1c) at 6 and 12 months from baseline. Data expressed as mean (standard error) by visit during the 12-month period. *MP*, multidisciplinary program; *UC*, usual care.

Supplementary Table 1
Changes in glycated hemoglobin at 6 and 12 months from baseline

A1C, %	Usual care group				Multidisciplinary program group				p Value †
	Mean (SE)	Δ	95% CI	p Value*	Mean (SE)	Δ	95% CI	p Value	
Baseline	9.62 (1.2)				9.74 (1.1)				0.31
6 months	9.06 (1.3)	−0.56	−1.04 to −0.08	0.02	9.24 (1.2)	−0.50	−1.10 to 0.10	0.14	0.52
12 months	9.10 (1.3)	−0.52	−1.07 to 0.04	0.08	9.44 (1.3)	−0.30	−1.05 to 0.44	1.00	0.33

A1C, glycated hemoglobin; *CI*, confidence interval; *SE*, standard error.
Note: Data presented as mean (SE), delta and 95% confidence interval, in an intention-to-treat analysis, adjusted for baseline A1C.
* Within-group A1C difference from baseline to 6 and 12 months.
† Between-group A1C difference in each time period.

Supplementary Table 2
Change in lipid profile, blood pressure and body mass index at 6 and 12 months from baseline

	Usual care group				Multidisciplinary program group				p Value †
	Mean (SE)	Δ	95% CI	p Value *	Mean (SE)	Δ	95% CI	p Value *	
Total cholesterol, mg/dL									
Baseline	170.7 (6.5)				166.0 (6.0)				0.61
12 months	172.2 (5.7)	1.5	−8.5 to 11.5	0.76	163.2 (4.8)	−2.8	−12.3 to 6.6	0.56	0.24
HDL-C, mg/dL									
Baseline	42.5 (1.8)				42.6 (2.0)				0.98
12 months	42.9 (1.9)	0.4	−1.5 to 2.1	0.73	42.8 (2.0)	0.2	−2.1 to 1.7	0.87	0.97
LDL-C, mg/dL									
Baseline	93.1 (6.3)				87.4 (5.0)				0.49
12 months	93.5 (5.3)	0.4	−9.4 to 10.1	0.94	83.0 (4.9)	−4.4	−13.1 to 4.3	0.32	0.15
Triglycerides, mg/dL									
Baseline	180.0 (12.4)				195.7 (13.7)				0.39
12 months	179.7 (12.1)	−0.3	−19.4 to 18.7	0.97	187.9 (15.6)	−7.8	−27.3 to 11.7	0.43	0.67
SBP, mmHg									
Baseline	140.0 (3.0)				134.3 (2.7)				0.17
6 months	135.7 (3.0)	−4.3	−9.4 to 0.7	0.12	134.6 (2.8)	0.3	−4.7 to 5.3	1.0	0.79
12 months	137.5 (3.4)	−2.5	−8.7 to 3.7	1.0	131.3 (2.9)	−2.9	−9.3 to 3.4	0.80	0.19
DBP, mmHg									
Baseline	76.3 (1.3)				78.3 (1.7)				0.38
6 months	74.4 (1.5)	−1.9	−4.3 to 0.4	0.16	77.9 (1.8)	−0.3	−2.8 to 2.1	1.0	0.13
12 months	75.1 (1.5)	−1.2	−4.5 to 2.0	1.0	76.4 (1.7)	−1.9	−5.2 to 1.3	0.48	0.58
BMI, kg/m^2									
Baseline	32.9 (0.8)				33.7 (1.0)				0.54
6 months	32.9 (0.8)	0.0	−0.5 to 0.4	1.0	34.3 (1.0)	0.6	−0.3 to 1.4	0.29	0.29
12 months	32.8 (0.8)	−0.1	−0.6 to 0.3	1.0	34.0 (1.0)	0.3	−0.2 to 0.8	0.34	0.34

BMI, body mass index; *CI*, confidence interval; *DBP*, diastolic blood pressure; *HDL-C*, high-density lipoprotein cholesterol; *LDL-C*, low-density lipoprotein cholesterol; *SBP*, systolic blood pressure; *SE*, standard error.
Note: Data expressed as mean (SE), change (Δ) and 95% CI using an intention-to-treat analysis.
* Within-group difference from baseline to 6 and 12 months.
† Between-group difference in each time period.