Comparative Effectiveness of Peer Leaders and Community Health Workers in Diabetes Self-management Support: Results of a Randomized Controlled Trial

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CLIN CARE/EDUCATION/NUTRITION/PSYCHOSOCIAL

OBJECTIVE

To compare a peer leader (PL) versus a community health worker (CHW) telephone outreach intervention in sustaining improvements in HbA_{1c} over 12 months after a 6-month diabetes self-management education (DSME) program.

RESEARCH DESIGN AND METHODS

One hundred and sixteen Latino adults with type 2 diabetes were recruited from a federally qualified health center and randomized to *1*) a 6-month DSME program followed by 12 months of weekly group sessions delivered by PLs with telephone outreach to those unable to attend or *2*) a 6-month DSME program followed by 12 months of monthly telephone outreach delivered by CHWs. The primary outcome was HbA_{1c}. Secondary outcomes were cardiovascular disease risk factors, diabetes distress, and diabetes social support. Assessments were conducted at baseline, 6, 12, and 18 months.

RESULTS

After DSME, the PL group achieved a reduction in mean HbA_{1c} (8.2–7.5% or 66–58 mmol/mol, $P < 0.0001$) that was maintained at 18 months (−0.6% or −6.6 mmol/mol from baseline [$P = 0.009$]). The CHW group also showed a reduction in HbA_{1c} (7.8 vs. 7.3% or 62 vs. 56 mmol/mol, $P = 0.0004$) post–6 month DSME; however, it was attenuated at 18 months (−0.3% or −3.3 mmol/mol from baseline, within-group $P = 0.234$). Only the PL group maintained improvements achieved in blood pressure at 18 months. At the 18-month follow-up, both groups maintained improvements in waist circumference, diabetes support, and diabetes distress, with no significant differences between groups.

CONCLUSIONS

Both low-cost maintenance programs led by either a PL or a CHW maintained improvements in key patient-reported diabetes outcomes, but the PL intervention may have additional benefit in sustaining clinical improvements beyond 12 months.

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To help improve their diabetes outcomes, adults with diabetes often need effective diabetes self-management education (DSME) followed by diabetes self-management support (DSMS). The National Standards for Diabetes Self-Management Education defines DSME as "the ongoing process of facilitating the knowledge, skill, and ability necessary for prediabetes and diabetes self-care," and DSMS consists of "activities that assist the person with prediabetes or diabetes in implementing and sustaining the behaviors needed to manage his or her condition on an ongoing basis beyond or outside of formal self-management training" (1).

DSME programs have been evaluated extensively (2–5). Yet, to date there is little evidence to guide subsequent DSMS efforts to maintain gains from DSME, especially in low-resource health care systems. Without ongoing DSMS, improvements achieved from DSME programs are short-lived (6 months or less) (4,5). This is especially the case for low-income ethnic and racial minorities in resource-poor settings such as inner-city communities where adults with diabetes face multiple challenges to self-management (6). Federally qualified health centers serving these communities lack resources to maintain professionally staffed care-management programs that can provide between-clinic visit outreach to patients who have completed short-term DSME programs. Thus, in the face of resource constraints, it is critically important to develop and evaluate low-cost, flexible, and sustainable DSMS approaches that do not rely on health care professionals to maintain gains achieved through DSME.

Intervention studies of DSMS have assessed delivery modalities including group-based support sessions, periodic educational reinforcement, telephone outreach, peer support groups, internet-based discussion boards, and automated telephone reminders (7–11). These programs have recruited a variety of DSMS interventionists including certified diabetes educators, psychologists, dietitians, care coordinators, physicians, health educators, and peers. To our knowledge, however, there are no published studies comparing two different models of ongoing DSMS delivered by nonprofessionals. Moreover, those few studies that have compared professional staff such as Certified Diabetes Educators and peer supporters have not examined long-term DSMS beyond 6 months (11). Accordingly, we compared a peer leader (PL) DSMS intervention with a community health worker (CHW) DSMS intervention as two possible approaches to maintain over a 12-month period health-related gains achieved through Journey to Health (JTH), an evidence-based, CHW-led, 6-month DSME program (12). In our prior trials, including one randomized controlled trial (RCT), JTH has been found to significantly improve short-term glycemic control compared with usual care (13,14).

RESEARCH DESIGN AND METHODS

Setting and Identification of Patients

This study was approved by the University of Michigan Institutional Review Board and was developed and implemented using community-based participatory research principles (15). It was conducted in partnership with the Community Health and Social Services (CHASS) Center, Inc., a federally qualified community health center located in Southwest Detroit, and the Racial and Ethnic Approaches to Community Health (REACH) Detroit partnership, a coalition of community organizations, academic institutions, and health care systems working to improve diabetes outcomes and care in east and southwest Detroit. Approximately 70% of residents of southwest Detroit are Latino of Mexican origin with an annual median household income of 27,248–31,097 USD (depending on zip code) and high rates of diabetes and obesity (16).

From November 2009 to July 2011, we identified participants from a computer-generated list of potentially eligible patients who were receiving medical care at CHASS with physician-diagnosed type 2 diabetes, were at least 21 years old, had a regular health care provider, and self-identified as Latino. We excluded individuals who had physical limitations preventing participation, terminal health conditions, serious psychiatric illness, and self-reported excessive alcohol or illicit drug use.

Recruitment and Randomization of the PL Versus CHW Telephone Outreach Study

The patients in this study represent a subsample of patients recruited for an RCT that continued recruitment beyond the time period of this substudy. That study compared outcomes between a larger group of participants receiving the 6-month JTH program and an arm that received enhanced usual care.

We contacted potentially eligible patients by telephone and screened for eligibility via phone or in the clinic. Eligible patients were invited to a group information session in which they were told that if they were randomized to the 6-month DSME, at the end of the DSME they would be offered either a CHW or a peer-led maintenance program over 12 months. Those interested in participating signed informed consent documents and enrolled in the study. Participants completed a baseline survey, and their HbA_{1c}, lipid panel, blood pressure (BP), height, weight, BMI, and waist circumference were measured. Participants were then randomized to one of two arms for the purpose of this substudy: *1*) a 6-month CHW-led JTH Program followed by 12 months of the peer support intervention or *2*) the 6-month CHW-led JTH program followed by 12 months of monthly CHW telephone outreach.

Random sequence generation and treatment group assignment were determined centrally just prior to the initial session. Sequence was concealed until interventions were assigned. Patients, research staff, and care managers were blinded to randomization results until completion of baseline assessments. Data assessors remained blinded to group assignment throughout the study. Participants received a stipend of 40 USD upon completion of each of the baseline, 6-month, 12-month, and 18-month assessments.

PLs

The PLs were volunteers and received only a modest stipend to defray costs of participation (e.g., transportation, child care). To be eligible for the study, PL candidates had to *1*) have diabetes, *2*) be a resident of the southwest Detroit community, *3*) be ≥21 years old, *4*) be bilingual in Spanish and English, *5*) be a graduate of JTH, *6*) have transportation to attend training, and *7*) be willing to commit to 3 months of training. Eligible PL candidates underwent a 46-h training program over 12 weeks (17). The training consisted of three main components: review of basic diabetes information;

communication, facilitation, and behavior modification skills; and practice applying skills in experiential learning scenarios. Specifically, PL candidates were trained to help patients build motivation for making lifestyle changes, use basic motivational interviewing skills (e.g., active listening and making reflections), apply empowerment-based facilitation strategies, set goals, develop action plans, and problem solve. To graduate successfully, candidates had to meet the pre-established competency criteria for four domains: diabetes knowledge, active listening, empowerment-based facilitation, and self-efficacy.

CHWs

The CHWs had an average of 6 years' experience leading DSME at CHASS. They were all employees of the health clinic and received a salary. They all came from southwest Detroit, had a high school diploma or GED, and were fluent in Spanish and of Latino origin. There was no requirement for them to have diabetes. They had completed 160 h of community outreach training and 80 h of diabetes education, home visit experiences, human subjects tutorial; had training in behavior modification strategies, JTH curriculum, cultural competency, motivational interviewing techniques, and community-based participatory research; and had basic computer and internet skills.

Description of Intervention

DSME Program

Both PL and CHW groups participated in the 6-month JTH program (12) delivered by CHWs trained in patient-empowerment approaches (18) and motivational interviewing (19). JTH consisted of three components: eleven 2-h culturally tailored interactive group self-management classes, two home visits (60 min in length) per month to help patients set and follow up on specific self-care goals (action plans), and one visit with the participant and his or her primary care provider. This 6-month program in our prior RCT among adults with diabetes at CHASS led to mean decreases of 0.8% HbA_{1c} compared with a 0.0% point drop among participants in the usual-care group (20).

PL DSMS

Adapted from the Lifelong Management program of Tang et al. (7), the PL intervention (delivered largely in Spanish) was designed to provide patients with ongoing emotional and behavioral support by PLs through group-based sessions and follow-up telephone contacts. Group-based DSMS sessions were offered weekly, with participants encouraged to attend sessions as often as needed. Based on patient-empowerment principles (18), discussion topics were driven by patients' self-identified priorities, questions, and concerns. The PLs did seek to complete at each session the following five tasks: discuss recent self-management challenges, share feelings about these challenges and other aspects of living with diabetes, engage in group-based problem solving, address questions about diabetes and its care, and set self-management goals. The PLs helped participants set goals using the five-step goal-setting model, which includes: *1*) exploring a participant-identified problem, *2*) discussing the emotional impact of the problem, *3*) selecting a self-management goal, *4*) developing an action plan, and *5*) executing and evaluating the action plan (20). PLs also provided support to participants by discussing psychosocial concerns, identifying facilitators and barriers to behavior change, taking inventory of support sources, and developing strategies to navigate the health care system.

To ensure regular contact with each participant, PLs made a telephone support call to any participant who had not attended a DSMS session over three consecutive weeks. During the telephone support calls, PLs facilitated a conversation that closely mirrored support activities conducted in the group setting.

CHW DSMS

Similar to the PL intervention, the CHW support is also based on empowerment principles and involved monthly telephone outreach initiated by a CHW over a period of 12 months. The monthly calls were structured around the five-step behavioral goal-setting model described above. During this call, CHWs also offered emotional support and helped participants understand how to effectively use the health care resources available to them. CHWs and participants were also encouraged to exchange email communication when needed.

Outcomes and Measurements

The primary clinical outcome was HbA_{1c}, as measured with a Bayer DCA 2000+ Analyzer (21). This assay has a test coefficient of variation $<5\%$ as required by the National Diabetes Data Group. Secondary clinical outcomes included a lipid panel (total cholesterol, LDL, and HDL), BP, BMI, and waist circumference. To measure lipids, we used the Cholestech LDX (Cholestech Corp., Hayward, CA) point-of-care machine (3), which has been found to meet National Cholesterol Education Program guidelines for measuring total cholesterol (22). Systolic and diastolic BP were taken with two readings on a Welch Allyn Speidel & Keller sphygmomanometer; the average readings were used in the analysis. All clients were weighed on an EverWeigh lithium digital scale. Heights and waist circumference were measured by the same technician at each time point. We used weight and height measurements to calculate BMI as weight in kilograms divided by the square of height in meters. Waist circumference was measured using the Tech-Med model cat. no. 4414 measuring tape and was measured at the umbilical waist.

All other measures were administered orally in patients' preferred language (English or Spanish). We assessed diabetes-related distress using the Diabetes Distress Scale (DDS), a 17-item instrument that assesses emotional distress and functioning specific to living with diabetes, with higher scores indicating higher levels of distress (23). We assessed diabetes-specific social support with an adapted version of the Diabetes Support Scale, a six-item instrument that assesses patient-perceived social support as it relates to meeting emotional needs, seeking advice, and obtaining information, with higher scores indicating more support (24).

Statistical Analysis

The sample size was estimated for longitudinal analysis with a linear mixed model to detect a difference of 0.6%, or 6.6 mmol/mol, in HbA_{1c} change between groups with 80% power and a two-sided α of 0.05. Although the UK Prospective Diabetes Study found that a 0.5%, or 5.5 mmol/mol, mean difference in HbA_{1c} translates into a 2.8% absolute risk reduction in diabetes events over a 10-year period (25), for recruitment concerns, our study was powered to detect a difference of 0.6%, or 6.6 mmol/mol. The power calculation was based on an SD of 1.75%, or 19.1 mmol/mol, and an intraclass correlation coefficient of 0.5 for repeated measures over time on the same individual (26).

For our analyses of our primary outcome of HbA_{1c}, we examined *1*) whether within-group HbA_{1c} gains achieved after 6 months of the JTH program were sustained at 18 months after receipt of their assigned DSMS intervention and *2*) whether there were differences in HbA_{1c} between the two groups at 18 months. Success of either arm in maintaining gains is indicated when P values < 0.05 are observed between baseline and follow-up time points, indicating that improvements in HbA_{1c} at month 6 were sustained at months 12 and 18. Secondary outcomes included sustained improvement at 18 months of changes between baseline and 6 months in cardiovascular disease risk factors, including total cholesterol, LDL cholesterol, HDL cholesterol, BP, BMI, and waist circumference, and the self-reported psychosocial measures.

All analyses were intention to treat. All continuous measures, except diabetes duration, were compared between the PL intervention and the CHW telephone outreach intervention with the Student *t* test. Diabetes duration was analyzed with the log-rank test . To check for differences between groups in categorical variables, the Fisher exact test was used if the expected count in any cell was under 5; Pearson χ^2 test was used for all other categorical variables.

All longitudinal outcomes, except the DDS, were analyzed by using a linear mixed model, except for the DDS, which was analyzed using a generalized estimating equation. Both the generalized estimating equation and linear mixed model allow for correlation among observations on the same person and enable participants to be included in the analysis if they had data at one or more time points (27,28). All models were adjusted for time (6, 12, and 18 months), study group, a time × study group interaction, and the baseline value. For all outcomes, the "intervention effect" was estimated as a contrast between the changes from baseline to follow-up between the two intervention groups.

Treatment of Missing Data

We also conducted sensitivity analyses that included variables for diabetes, cholesterol, and blood pressure medication intensification to ensure that intervention effects were not principally due to medication intensification. As there was no change in the results, we report the unadjusted results.

We followed CONSORT (Consolidated Standards of Reporting Trials) guidelines for analyses and reporting (29).

RESULTS

Participant Flow and Baseline Data

Of the 756 potentially eligible patients, 54% (n = 406) did not meet inclusion criteria, and 23% (n = 177) could not be contacted (Fig. 1). Of the 173 eligible patients, 4% (n = 7) consented but were not randomized and 29% (n = 50) declined to participate. Of 116 randomized patients, 96 had HbA_{1c} data at the 6-month assessment, 83 at the 12-month post–JTH assessment, and 69 at the 18-month assessment (attrition rate 41%) (Fig. 1). Loss to follow-up was not different between the two groups and was not associated with clinical or demographic variables. When comparing study participants (n = 116) with the eligible population (n = 173) to determine generalizability, there were no statistical differences in demographic variables.

Patient characteristics are presented in Table 1. There were no significant differences in baseline characteristics between groups (Table 1), except for a borderline significant difference in diabetes social support (PL 4.0 vs. CHW 4.4, P = 0.053).

Glycemic Control

At 6 months, all participants experienced on average a significant reduction in HbA_{1c} levels (PL −0.7% or −7.7 mmol/mol, $P < 0.0001$; CHW −0.5% or −5.5 mmol/mol, P = 0.004) (Table 2; Fig. 2). These improvements were maintained in both groups at 12 months (PL −0.6% or −6.6 mmol/mol, P = 0.001; CHW −0.4% or −4.4 mmol/mol, P = 0.011). However, at 18 months, the PL group sustained their initial HbA_{1c} improvement (−0.6% or −6.6 mmol/mol, P = 0.009), while the CHW group's average HbA_{1c} levels began to rise (−0.3% or −3.3 mmol/mol, P = 0.234). There were no significant differences between groups at any time point (Table 2), and neither group returned to baseline.

Cardiovascular Risk Factors

LDL Cholesterol

At 6 and 12 months, there were no statistically significant changes in LDL cholesterol levels for either group. At 18 months, PL group participants experienced significant declines in mean LDL levels, by close to 14 mg/dL at 18 months, while the CHW group experienced no improvements (PL −14.3 mg/dL, P = 0.009; CHW −8.4 mg/dL, P = 0.103). There were no significant between-group differences at any time point for LDL (Table 2).

Blood Pressure

Within the PL group, average systolic and diastolic BPs declined by 6.6 mmHg (P = 0.001) and 3.9 mmHg (P = 0.001), respectively, from baseline to 6 months, and the results were sustained at 12 months (systolic BP −6.4 mmHg, P = 0.003; diastolic BP 4.1 mmHg, P = 0.002) and 18 months (systolic BP −5.8 mmHg, P = 0.010; diastolic BP −3.4 mmHg, P = 0.013) (Table 2). None of the improvements in blood pressure in the CHW group were statistically significant (Table 2).

Waist Circumference

Average waist circumference decreased significantly in both groups at 6 months (PL −1.8 inches, $P < 0.001$; CHW −1.4 inches, P = 0.001), with no significant differences between groups. At 18 months, both groups sustained a −1.3 inch reduction (P = 0.001) in waist circumference. There were no significant long-term changes in HDL or in BMI.

Psychosocial Outcomes

Diabetes Social Support

Table 2 also shows changes in perceived diabetes social support over time for both groups. From baseline to 6 months, levels of social support increased within both groups (PL 1.0, $P < 0.0001$; CHW 0.6, $P < 0.0001$). Both groups sustained the improvements in social support at 12 months (PL 0.8, $P < 0.0001$; CHW 0.4, P = 0.001) and at 18 months (PL 0.6, P = 0.0001; CHW 0.3, P = 0.050); however, the intervention effects were only significant between groups at 6 months (P = 0.0004) and at 12 months (P = 0.025) (Table 2).

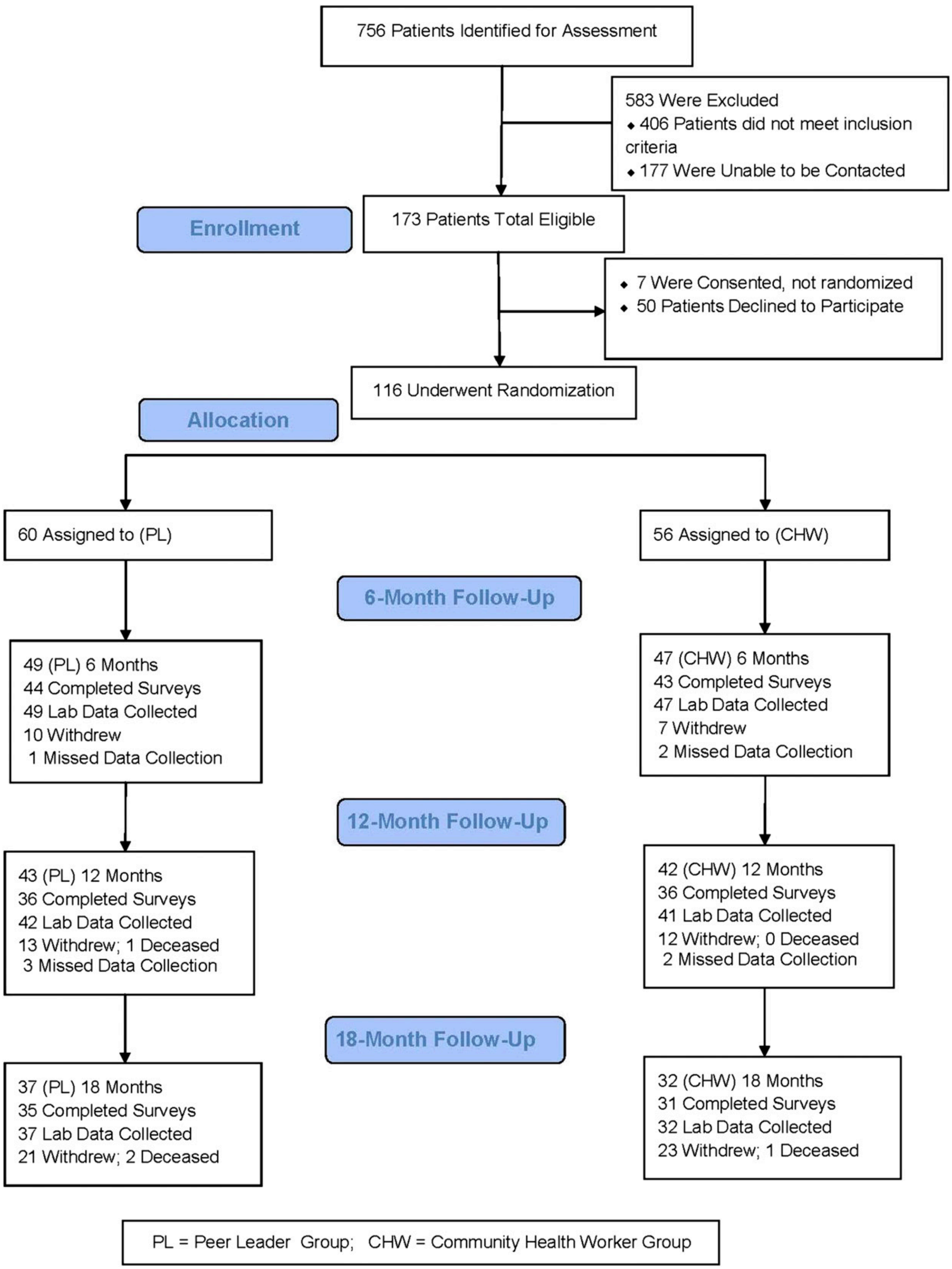

Figure 1—CONSORT flow diagram for Detroit, 2012.

Diabetes Distress

Significant decreases in the proportion of individuals who reported high diabetes distress occurred at the 6-month follow-up in each group. However, the reductions in the proportion of individuals with high diabetes distress were not sustained beyond 6 months in either group. In contrast, the proportion of individuals who reported moderate diabetes distress levels in the CHW group decreased from 28.6% to 14.5% at the 6-month follow-up, *P* = 0.013, and was sustained at 12 months (16.2%, *P* = 0.003) and at 18 months (18.8%, *P* = 0.030). Within the PL group,

Table 1—Baseline characteristics of CHASS participants (*N* = 116)

Characteristic	PL group	CHW group	Total	*P* for between-group difference
n	60	56	116	
Age (years), mean (SD)	50.2 (11.1)	48.4 (10.8)	49.3 (11.0)	0.36[a]
Men, *n* (%)	28 (46.7)	20 (35.7)	48 (41.4)	0.23[b]
Spanish speaking, *n* (%)	49 (81.7)	51 (91.1)	100 (86.2)	0.14[b]
Education, *n* (%)				0.33[c]
≤Some high school	43 (71.7)	46 (83.6)	89 (77.4)	
High school graduate or GED	10 (16.7)	6 (10.9)	16 (13.9)	
Some college/technical/vocational training	7 (11.7)	3 (5.5)	10 (8.7)	
≥College graduate	0 (0.0)	0 (0.0)	0 (0.0)	
Employed, *n* (%)	26 (43.3)	25 (44.6)	51 (44.0)	0.89[b]
Have health insurance, *n* (%)			100 at federally qualified health center	N/A
Household income (USD), *n* (%)				0.13[b]
<20,000	55 (96.5)	46 (92.0)	101 (94.4)	
20,000–49,999	5 (8.8)	10 (20.0)	15 (14.0)	
≥50,000	0 (0.0)	0 (0.0)	0 (0.0)	
Social support				
Married or partnered, *n* (%)	45 (75.0)	38 (67.9)	83 (71.6)	0.39[b]
Diabetes social support, mean (SD)	4.0 (1.2)	4.4 (1.0)	4.2 (1.1)	0.053[a]
Antihyperglycemic medication, *n* (%)				0.78[c]
No medications	3 (5.0)	2 (3.6)	5 (4.3)	
Only oral diabetes medication	45 (75.0)	40 (71.4)	85 (73.3)	
Insulin with or without medication	12 (20.0)	14 (25.0)	26 (22.4)	
Self-rated fair or poor general health, *n* (%)	44 (73.3)	45 (80.4)	89 (76.7)	0.37[b]
Minimal depression, *n* (%)[d]	14 (23.3)	11 (19.6)	25 (21.6)	0.63[b]
DDS[e]				0.36[b]
Little or no distress	37 (61.7)	28 (50.0)	65 (56.0)	
Moderate distress	11 (18.3)	16 (28.6)	27 (23.3)	
High distress	12 (20.0)	12 (21.4)	24 (20.7)	
Physiological measures, mean (SD)				
HbA_{1c} (%)	8.2 (2.2)	7.8 (1.7)	8.0 (2.0)	0.25[a]
HbA_{1c} (mmol/mol)	66.0 (24.0)	62.0 (18.6)	64.0 (21.9)	0.25[a]
LDL cholesterol (mg/dL)	102.1 (35.3)	95.5 (29.9)	98.9 (32.8)	0.33[a]
HDL cholesterol (mg/dL)	40.5 (16.8)	40.7 (13.8)	40.6 (15.3)	0.95[a]
Systolic BP (mmHg)	134.8 (17.8)	131.6 (18.2)	133.3 (18.0)	0.34[a]
Diastolic BP (mmHg)	81.2 (10.1)	78.7 (10.8)	80.0 (10.5)	0.19[a]
BMI (kg/m^2)	33.0 (7.6)	32.0 (4.6)	32.5 (6.3)	0.28[a]
Waist circumference (inches)	41.8 (6.3)	40.6 (4.8)	41.2 (5.6)	0.26[a]
Diabetes duration (years)	6.7 (5.8)	6.4 (6.1)	6.6 (5.9)	0.80[f]

[a]*t* Test. [b]Pearson χ^2 test. [c]Fisher exact test. [d]Minimal depression indicated by PHQ (Primary Care Evaluation of Mental Disorders) ≥3. [e]DDS <2, little or no distress; 2 ≤ DDS < 3, moderate distress; DDS ≥3, high distress. [f]Log-rank test.

the proportion of individuals who reported moderate diabetes distress declined but not significantly until 18 months (baseline 18.3%, 18 month 7.0%, *P* = 0.026).

Frequency of PL-Participant and CHW-Participant Contacts

All contact data are based on participant self-report. Total number of contacts was calculated by adding number of group sessions participants reported attending plus number of telephone support calls received for the PL group and total number of telephone support calls received plus number of emails exchanged for the CHW group. In the PL group, 45.0% (*n* = 27) had at least one contact with his/her PL between 6- and 18-month assessments, with an average of 3.67 contacts. In the CHW group, 53.6% (*n* = 30) had at least one contact with his/her CHW between 6- and 18- month assessments, with an average of 2.88 contacts. No significant differences in mean or percentage contacts were found between the PL and CHW groups.

CONCLUSIONS

Among this sample of low-income, predominantly Spanish-speaking adults with diabetes who receive care at a federally qualified health center, both the PL and CHW interventions were effective in sustaining achieved HbA_{1c} improvements from a 6-month CHW-led DSME program up to and including 12-month follow-up. At 18-month follow-up, the groups diverged as the PL group sustained improvement in HbA_{1c}, while the CHW group did not. However, it should be noted that there were no significant between-group differences in the amount of improvement observed between the groups.

Unlike the CHW group, the PL group sustained statistically and clinically

Table 2—Changes in clinical and psychosocial outcomes over time

Outcome and time point	Baseline	6 months–baseline	12 months–baseline	18 months–baseline
HbA_{1c} (%)*				
PL	8.2 (7.7–8.8)	−0.7 (−1.0 to −0.4), $P < 0.0001$	−0.6 (−0.9 to −0.3), P = 0.001	−0.6 (−1.0 to −0.2), P = 0.009
CHW	7.8 (7.4–8.3)	−0.5 (−0.8 to −0.3), P = 0.0004	−0.4 (−0.7 to −0.1), P = 0.011	−0.3 (−0.7 to 0.2), P = 0.234
CHW vs. PL**	0.253	0.883	0.867	0.725
HbA_{1c} (mmol/mol)*				
PL	66.0 (61.0–73.0)	−7.7 (−10.9 to −4.4), $P < 0.0001$	−6.6 (−9.8 to −3.3), P = 0.001	−6.6 (−10.9 to −2.2), P = 0.009
CHW	62.0 (57.0–67.0)	−5.5 (−8.7 to −3.3), P = 0.0004	−4.4 (−7.7 to −1.1), P = 0.011	−3.3 (−7.7 to 2.2), P = 0.234
CHW vs. PL**	0.253	0.883	0.867	0.725
LDL cholesterol (mg/dL)*				
PL	102.1 (92.0–112.2)	2.1 (−6.9 to 11.0), P = 0.647	0.8 (−8.7 to 10.3), P = 0.866	−14.3 (−24.8 to −3.7), P = 0.009
CHW	95.5 (86.8–104.2)	3.9 (−4.8 to 12.6), P = 0.379	1.2 (−8.5 to 10.8), P = 0.811	−8.4 (−18.4 to 1.6), P = 0.103
CHW vs. PL**	0.327	0.775	0.958	0.428
HDL cholesterol (mg/dL)*				
PL	40.5 (36.0–45.0)	0.4 (−2.4 to 3.2), P = 0.798	3.0 (−0.1 to 6.0), P = 0.057	0.6 (−2.5 to 3.7), P = 0.706
CHW	40.6 (36.9–44.4)	1.0 (−1.8 to 3.8), P = 0.482	2.1 (−0.9 to 5.2), P = 0.167	−1.4 (−4.6 to 1.7), P = 0.371
CHW vs. PL**	0.955	0.754	0.710	0.366
Systolic BP (mmHg)*				
PL	134.8 (130.2–139.4)	−6.6 (−10.5 to −2.7), P = 0.001	−6.4 (−10.6 to −2.2), P = 0.003	−5.8 (−10.2 to −1.4), P = 0.010
CHW	131.6 (126.7–136.5)	−3.8 (−7.8 to 0.2), P = 0.061	−3.1 (−7.3 to 1.2), P = 0.158	−1.0 (−5.7 to 3.6), P = 0.661
CHW vs. PL**	0.344	0.335	0.278	0.148
Diastolic BP (mmHg)*				
PL	81.2 (78.6–83.8)	−3.9 (−6.3 to −1.6), P = 0.001	−4.1 (−6.6 to −1.6), P = 0.002	−3.4 (−6.1 to −0.7), P = 0.013
CHW	78.7 (75.8–81.6)	−0.7 (−3.1 to 1.8), P = 0.596	−2.0 (−4.5 to 0.6), P = 0.135	−0.7 (−3.6 to 2.1), P = 0.623
CHW vs. PL**	0.194	0.058	0.247	0.178
BMI (kg/m^2)*				
PL	33.1 (31.2–35.1)	0.1 (−0.2 to 0.4), P = 0.462	0.2 (−0.2 to 0.6), P = 0.371	0.3 (−0.2 to 0.8), P = 0.247
CHW	31.9 (30.6–33.1)	−0.4 (−0.8 to −0.1), P = 0.007	−0.4 (−0.8 to 0.0), P = 0.074	−0.2 (−0.7 to 0.4), P = 0.553
CHW vs. PL**	0.284	0.015	0.058	0.221
Waist circumference (inches)*				
PL	41.8 (40.2–43.4)	−1.8 (−2.5 to −1.1), $P < 0.0001$	−1.7 (−2.6 to −0.8), P = 0.0004	−1.3 (−2.1 to −0.6), P = 0.001
CHW	40.6 (39.4–41.9)	−1.4 (−2.1 to −0.8), $P < 0.0001$	−1.8 (−2.7 to −0.9), P = 0.0003	−1.4 (−2.1 to −0.6), P = 0.001
CHW vs. PL**	0.263	0.460	0.903	0.985
Diabetes Support Scale*				
PL	4.0 (3.7–4.3)	1.0 (0.8–1.1), $P < 0.0001$	0.8 (0.6–1.1), $P < 0.0001$	0.6 (0.3–0.9), P = 0.0001
CHW	4.4 (4.1–4.7)	0.6 (0.4–0.7), $P < 0.0001$	0.4 (0.2–0.7), P = 0.001	0.3 (0.0–0.6), P = 0.050
CHW vs. PL**	0.053	0.0004	0.025	0.165

Data are estimates for means (95% CI). Linear mixed model for all clinical outcomes and diabetes support. Baseline to 18-month follow-up (N = 116: n = 56 CHW, n = 60 PL). All difference scores adjusted for baseline values. *P values for within-group difference from given time point to baseline. **Between-group P values. Baseline tests from Student t test; difference scores relative to baseline from linear mixed model implemented in SAS Proc Mixed.

significant improvements in HbA_{1c} and BP to 18 months. By design, the PL intervention of weekly face-to-face group sessions supplemented by telephone support calls offers greater intensity and frequency of support to participants than the CHW intervention of monthly telephone support calls supplemented by emails. Therefore, any advantages

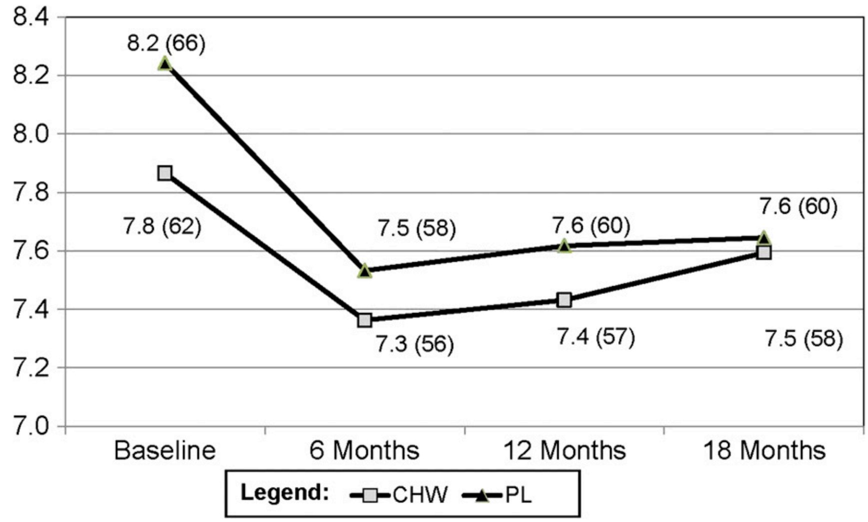

Figure 2—Trajectory of HbA_{1c} means from baseline to 18 months. Data are presented as % (mmol/mol).

in long-term health maintenance by the PL group should be interpreted with caution. However, since there was no difference in the mean number of PL participant and CHW participant contacts, these findings cannot be attributed to a treatment dosage effect. It is possible that the PL intervention outperformed the CHW telephone intervention because participants felt a closer connection and greater identification with PLs who also live with the challenges of having diabetes. This question should be explored in future studies.

As originally designed, the core support mechanism of the PL intervention was intended to be weekly group support sessions. Although regular logs were not kept, the PLs all reported having substantially more telephone support contact with participants than group-based face-to-face contact. While we expected variations in preferred communication modality across participants, we did not predict that the originally designed group intervention would essentially transform into a telephone outreach intervention. Upon further investigation, we learned that it required great effort for some patients to attend sessions (e.g., taking two different bus lines to reach the clinic). Other participants had other priorities (e.g., child care, employment) that took precedence over attending a weekly peer-led session. Consistent with these reports, in a qualitative study of 37 Latino adults with personal or familial experience with diabetes, Baig et al. (30) found lack of time a major deterrent to attending regular group-based, peer-led self-management interventions. Consequently, we did not actually test two different delivery modalities as the primary support mechanism, as both interventions consisted of telephone outreach. Notwithstanding, we were still able to compare two similar interventions delivered by two different types of interventionists (PL vs. CHW) who were not formal health care professionals.

To date, all RCTs investigating CHW-led diabetes self-management interventions targeting the Latino community have focused on comparing CHWs with usual care (31,32), CHWs with CHWs using different interventions (33), CHWs versus attention control (34), and CHWs versus wait-list usual care (35,36). The current study is the first to use a rigorously designed RCT to compare the effectiveness of two different types of nonprofessional delivery models in sustaining diabetes-related health outcomes. That both interventions produced positive clinical and psychosocial outcomes has important implications for health systems in low-resource settings. It should be noted that not all Latino communities find a peer support model culturally acceptable. However, with respect to the current study, the majority of participants agreed that having a PL was important (81%) and that the PLs played a critical role in the intervention (100%).

Like other studies using nonprofessional delivery models (37), we did not include a formal cost-effectiveness analysis. The few CHW-led interventions that have examined cost-related variables have reported favorable results (38–40). While not comprehensive, we did document some basic data that allows us to compare the relative labor-related costs of the PL and CHW interventions. PLs in this study received a small stipend for training and intervention delivery (annual stipend of ~1,000 USD), while the CHWs were salaried employees receiving benefits (annual salary ~29,120 USD). Compared with CHWs, training PLs to provide ongoing DSMS might thus result in substantial cost savings, especially in settings in which CHWs are not already employed. For communities that do not have the financial resources to even hire CHWs, recruiting and training PLs could be a viable evidence-based option.

Some limitations need mentioning. First, as noted, in the absence of a formal cost-effectiveness analysis we cannot demonstrate any cost savings or quality-adjusted life-years associated with the two interventions. Second, given that the PL and CHW interventions were designed to offer different treatment intensity levels, comparing the two interventions may not have been equitable. Fortunately, our analysis of mean number of participant-reported contacts revealed that intervention dosage was similar for both groups. Third, our follow-up rate of 59% was low compared with the 63–93% range reported in other studies targeting the Latino community (10,32). However, this 18-month intervention was lengthier (32) and used a stricter definition for "dropouts" (31) than some other studies. While we used effective retention strategies such as requesting contact information from multiple friends or family members and accommodating participants' availability for assessments, we were not able to use more costly methods such as providing paid taxis, conducting assessments at participants' homes, or hiring staff dedicated exclusively to addressing participant retention. Clearly, for very low-income, non–English speaking populations, future research needs to explore more effective and sustainable yet low-cost approaches to keeping participants engaged.

In conclusion, among these low-income inner-city Latino adults with diabetes, both PL-led and CHW-led DSMS models resulted in maintenance of gains achieved in an evidence-based DSME program. The sustained improvements in HbA_{1c} that we observed are equivalent to those achieved in more resource-intensive health professional–led care management programs. This is encouraging news to health care centers in low-resource settings facing significant financial constraints. It suggests that to promote long-term ongoing diabetes self-management efforts, we may need only to look toward individuals in our own communities as valuable sources for self-management support.

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