

Translation of the Diabetes Prevention Program's Lifestyle Intervention: Role of Community Health Workers

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Abstract Approximately 8.3% of the US population has diabetes and estimates indicate that 79 million adults have prediabetes and 33.8% are obese, increasing their risk of diabetes. The national Diabetes Prevention Program (DPP) and subsequent translation studies have demonstrated the efficacy of the DPP lifestyle intervention (DPPLI) on lowering weight and reducing risk of type 2 diabetes over 10 years. Innovative strategies are needed to translate the DPPLI to reach people at risk of diabetes. Community health workers represent a group of individuals poised to play a role in supporting the translation of the DPPLI, especially in underserved populations. This article aims to 1) describe community health workers in general; 2) describe their role and impact on diabetes care in general; and 3) provide a detailed overview of studies involving community health workers in the translation of the DPPLI.

Keywords Diabetes · Prevention, diabetes prevention program · Lifestyle intervention · Community health worker ·

Translation · Diabetes education · Obesity · Multidisciplinary health care teams · Underserved

Introduction: Background on Diabetes, Prediabetes, and Obesity

Diabetes mellitus is one of the most common chronic diseases throughout the world. The number of those affected is increasing rapidly as economic development and urbanization lead to sedentary lifestyles and increased obesity [1]. Approximately 25.8 million in the United States (8.3%) have diabetes, including 18.8 million who are diagnosed and 7.0 million undiagnosed [2]. Estimates indicate that 33.8% of US adults are obese [3] and 79 million have prediabetes [2]. There has been a dramatic increase in obesity in the United States over the past two decades. In 2010, there was no state with an obesity prevalence of less than 20% [3] and 12 states had reached a prevalence of 30% or greater [4]. Reducing obesity, by improving eating and physical activity habits, represents an important path to reducing the risk of diabetes [5].

Obesity [6] and diabetes disproportionately affect minority populations [2]. Non-Hispanic blacks have the highest rates of obesity (44.1%) compared to Mexican Americans (39.3%), all Hispanics (37.9%), and non-Hispanic whites (32.6%) [4]. Furthermore, 8.4% of Asian Americans, 11.8% of Hispanics/Latinos, and 12.6% of non-Hispanic blacks have diagnosed diabetes, compared with 7.1% of non-Hispanic whites [2]. In addition, an estimated 16.1% of the total adult population served by the Indian Health Service has diagnosed diabetes [2]. Other underserved populations at higher risk of diabetes include older adults and lower income groups [7]. Widening health disparities [8] and the aging of the US population [9] will continue to expand the

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number of people with diabetes if effective prevention interventions are not translated to reach these groups, among others at risk.

The growing epidemic of obesity and diabetes requires urgent, diverse, and broad efforts to have a major impact in these public health challenges. The national Diabetes Prevention Program (DPP) [10, 11] and subsequent translation studies have demonstrated the efficacy of the DPP lifestyle intervention (DPPLI) on lowering weight [12•, 13–17, 18••, 19, 20, 21••, 22•, 23] and reducing risk of type 2 diabetes over 10 years [11]. Innovative strategies are needed to translate the efficacious DPPLI to reach the estimated 79 million people with prediabetes [2] and the even greater number of obese adults at risk for diabetes [4]. Efforts are especially needed to reach underserved and/or populations who are at higher risk of obesity and diabetes.

Shortage of Health Professionals: A Role for Community Health Workers

The shortage of health professionals has been recognized as a global issue, and efforts have been initiated to identify ways to extend our health care workforce [24]. One group, community health workers (CHWs), may offer hope in providing additional help, particularly for underserved populations. CHWs have been serving an important role in supporting the health needs of their communities across the globe for many years. Recently, the World Health Organization's Global Health Workforce Alliance conducted a systematic review of the literature on the global experience of CHWs. The executive summary of the final document noted that "Participation of community health workers (CHWs) in the provision of primary health care has been experienced all over the world for several decades, and there is an amount of evidence showing that they can add significantly to the efforts of improving the health of the population, particularly in those settings with the highest shortage of motivated and capable health professionals" (p. 11) [25]. In addition, [25] stated:

The World Health Report 2006 argued that community health workers (CHWs) have the potential to be part of the solution to the human resource crisis affecting many countries. CHWs provide a variety of functions, including outreach, counseling and patient home care and represent a resource to reach and serve disadvantaged populations. There has been mounting evidence to demonstrate the positive potential of community health workers in improving equitable access to care and health outcomes.

Therefore, the overall goal of this paper is to describe the role of CHWs in the translation of the DPPLI. Secondary

objectives are to 1) describe CHWs in general; 2) describe their role and impact on diabetes care in general; and 3) provide a detailed overview of studies involving CHWs in the translation of the DPPLI.

General Definition of CHW

The US Department of Health and Human Services (USDHHS) Health Resources and Services Administration Bureau of Health Professions conducted a Community Health Worker National Workforce Study [26]. In the report on this study, the USDHHS defined CHWs as:

...lay members of communities who work either for pay or as volunteers in association with the local health care system in both urban and rural environments and usually share ethnicity, language, socioeconomic status, and life experiences with the community members they serve. They have been identified by many titles such as community health advisors, lay health advocates, "promotores(as)," outreach educators, community health representatives, peer health promoters, and peer health educators. CHWs offer interpretation and translation services, provide culturally appropriate health education and information, assist people in receiving the care they need, give informal counseling and guidance on health behaviors, advocate for individual and community health needs, and provide some direct services such as first aid and blood pressure screening. (p. 3–4 executive summary).

Diabetes-Specific Definition of CHWs

The potential role of CHWs in diabetes has recently been identified by the American Association of Diabetes Educators (AADE), and CHWs have been included within Level 1 of the 5 levels of diabetes educators [27, 28]. The AADE [29] stated:

Community health workers (Level 1 providers) are non-diabetes educators uniquely positioned to collaborate with diabetes educators and other providers to improve the quality of diabetes education, care, and prevention in communities. CHWs dedicated to diabetes prevention and care are likely to have completed specialized training. They can serve as bridges between their ethnic, cultural, or geographic communities and health care providers, and they engage their community to prevent diabetes and its complications through education, lifestyle change, self-management, and social support. CHWs also play a vital role in data gathering and data entry. (p. 3).

In a 2009 position statement, the AADE [30] defined a CHW as a: Frontline public health worker who is a trusted member of and/or has an unusually close understanding of the community served. This trusting relationship enables the CHW to serve as a liaison/link/intermediary between health/social services and the community to facilitate access to services and improve the quality and cultural competence of service delivery. A CHW also builds individual and community capacity by increasing health knowledge and self-sufficiency through a range of activities such as outreach, community education, informal counseling, social support, and advocacy. (p. 49S).

The AADE [30] also described the following positions regarding inclusion of CHWs:

1. Diabetes educators and other health care professionals should support:
 - a. the role of CHWs in serving as bridges between the health care system and people with and at risk for diabetes;
 - b. the role of CHWs in primary and secondary prevention;
 - c. continued research that evaluates the roles, contributions, and effectiveness of CHWs.
2. “CHWs should receive effective training in core diabetes skills and competencies”; and
3. “There should be reciprocal exchange of information and support between CHWs and the health care team to facilitate the best outcomes for people with and at risk for diabetes.” (p. 48–49S).

Evidence Supporting Benefits of CHWs in Diabetes: Community-Based Screening, Awareness, and Support

Several studies reported beneficial outcomes for the use of CHWs in community screening, diabetes awareness, and support. A systematic review of 18 studies (including 8 randomized clinical trials [RCTs]) by Norris et al. [31] evaluated evidence of the roles of CHWs and the impact on measurable diabetes outcomes. CHWs were engaged in patient care and support, outreach, patient education, instrumental support to other health care professionals in delivery of care and educational programs, and liaisons with the health care system. Interventions using CHWs as team members reported significant improvements in knowledge of diabetes and self-care practices, particularly glucose self-monitoring, diet, and physical activity. Physiologic variables such as hemoglobin A_{1c} (HbA_{1c}), blood pressure, and lipid levels also reportedly showed improvement; and health care utilization measured by number of emergency visits and hospital admissions was significantly reduced.

A recent study by Castillo et al. [32] examined a community diabetes education and support intervention led by CHWs. In this study, CHWs received 20 hours of intensive training in the Diabetes Empowerment Education Program (DEEP) [32] followed by coaching, supervision, and support from experienced CHWs and research staff. Trained CHWs then provided diabetes education and support to 70 community residents following the standardized DEEP curriculum. At the end of the 3-month intervention, results showed significant improvements in diabetes knowledge, self-care behaviors, and clinical measures, including HbA_{1c}, blood pressure, and depression [32]. In addition, a subsample was assessed on self-efficacy and showed a trend toward significant improvement.

An RCT by Lorig et al. [33] examined the effectiveness of a 6-week community-based diabetes self-management program compared to usual care on health status, self-management behaviors, and self-efficacy. Three hundred forty-five community residents with type 2 diabetes were assessed at 6 and 12 months post-intervention. CHWs received intensive training in the delivery of the Diabetes Self-Management Program [33], and further coaching in class management, teaching strategies, and program logistics. The study showed significant improvements at 6 months in hypoglycemia; depression scores; communication with physician; self-care behaviors, including exercise, glucose monitoring, healthy eating, and reading food labels; self-efficacy scores; and patient activation. The 12-month follow-up showed maintenance of improvements in depression, healthy eating, provider communication, patient activation, and self-efficacy.

A qualitative evaluation by Davis et al. [34] described CHWs engaged in providing assistance, teaching skills, distributing information, recruiting, and monitoring progress. The skills most often taught by CHWs were related to blood glucose monitoring, healthy eating, and physical activity. They provided assistance in goal setting, problem solving, emotional support, encouragement/motivation, and instrumental support for the patient with diabetes. Patients' reports consistently expressed their appreciation for the CHWs' encouragement, assistance with personal needs and motivation, and the accessibility, attentiveness, and openness in their interactions. In summary, CHWs make meaningful contributions to outreach, screening, patient education, and support, and do so in a manner that is culturally sensitive and focused on eliminating patient barriers to optimal self-care.

Evidence Supporting Benefits of CHWs in Diabetes: Role on Multidisciplinary Health Care Team

To date, only a small number of published papers report on the inclusion of CHWs as members of the health care team.

One of the few examples included an evaluation of a service project for patients in Medicaid using a nurse care management/peer education team approach [35]. In this project, CHWs received additional training to serve as diabetes peer educators and delivered diabetes education curriculum to low-income, low-literacy patients. The team collaboration proved effective in significantly improving health outcomes, including glycemic control, total cholesterol, low-density lipoprotein (LDL), triglycerides, and diastolic blood pressure; diabetes knowledge; treatment satisfaction; and health beliefs. Another study, an RCT by Babamoto et al. [36], compared a CHW approach to nurse case management and to standard provider care for newly diagnosed patients with type 2 diabetes in an inner city population. CHWs were considered paid clinical staff and met the organization's requirements of having a high school degree or general equivalency degree (GED). After receiving formal program training, CHWs conducted educational sessions based on American Diabetes Association standards that were tailored to the participant's needs and followed a format that offered accessibility and flexibility to the participant. Even though all three groups significantly reduced HbA_{1c}, the CHW intervention had the greatest impact on modifiable risk factors (exercise, fruit and vegetable intake, body mass index [BMI]), medication-taking behavior, diabetes knowledge, reduction in emergency department admissions, and patients' self-reported health status. Another example of integration of CHWs in the health care team is a model that used a pharmacist-CHW team to improve self-care and reduce barriers in medication adherence among Latinos with type 2 diabetes [37]. Gerber et al. [37] detailed procedures of the CHW interaction with the pharmacist and the patient and highlighted the intensity of the effort required to achieve adequate medication adherence. The role of the CHW was to facilitate communicating, interpreting, and reinforcing the provider's instructions, while maintaining a personal connection with the patient.

A study by Thompson et al. [38] reported on the effectiveness of CHWs trained in the Trans-theoretical Model of Change (TTM) to provide diabetes management education and support to a cohort of 142 patients in an inner city clinic. The intervention included the addition of two components to the usual care provided by the clinic: CHWs worked one on one with patients at least weekly for the first 6 months and monthly thereafter; and CHWs provided patient-centered counseling using the TTM. This clinic integrated CHWs into the health care team, with providers and CHWs sharing patient information and collaborating in patient care. CHWs received training in popular education, group facilitation, communication, presentation, and analysis. They also received intensive training in diabetes education and the TTM, and ongoing instruction and support for the duration of the project. Providers also received training in the TTM.

This pre-/post-test study observed significant improvements in HbA_{1c} at the 6- and 12-month follow-ups. Other measures (cholesterol, blood pressure, BMI) showed improvement but did not reach statistical significance. Changes in HbA_{1c} correlated with the frequency of weekly CHW contacts, so that patients with the greatest number of contacts with CHWs showed the greatest change in HbA_{1c} levels. Besides one-on-one counseling, CHWs provided community outreach, led walking clubs and diabetes self-management classes, and facilitated cognitive-behavioral group therapy led by a mental health professional. Finally, a study by Otero-Sabogal et al. [39] reported the successful partnership of physicians with CHWs in implementing a team model of diabetes care. CHWs worked closely with physicians, a Certified Diabetes Educator and a social worker in developing and following up on action plans for the patient's management. This pre-/post-test prospective pilot study assessed changes in clinical and patient activation measures in a cohort of 114 patients enrolled in the clinic. Over the course of 2 years, patients received interventions by the primary care provider complemented by the CHW's interventions that included diabetes education, medication adherence, self-management support, group support, navigation, and follow-up phone support. The study also reviewed patient satisfaction and providers' satisfaction with the CHW roles. Statistically significant improvements were reported on glycemic levels, LDL, total cholesterol, and patient activation. Patients reported a high level of satisfaction with the provider-CHW relationship and how it facilitated patient-provider communication. Providers gave a very positive evaluation of the work of the CHWs, and their patients were better educated, had improved self-management, and reduced the number of unnecessary visits and hospitalizations.

The studies examining models of including CHWs as part of a multidisciplinary diabetes care team have shown promising results. Because few studies have been conducted and only one was an RCT, more research is needed to further investigate the role of CHWs on the diabetes care team.

Evidence Supporting the Benefits of CHWs in Prevention: DPPLI Translation Efforts

To date, six studies that focused on the translation of the DPPLI have incorporated CHWs into their work in some manner (Tables 1 and 2). These include two primary CHW models: 1) serving as the primary interventionists delivering the DPPLI in various community settings; and 2) participating as a team member and serving a supportive role for health professional delivery of the DPPLI. An overview of each of these DPPLI translation studies will be provided

Table 1 DPPLI translation studies including CHWs: randomized studies

Study	Sample characteristics	Design and interventions	Weight-related measurement	Weight-related outcomes
Ackermann et al. [12•]	<p>Primary inclusion criteria:</p> <ul style="list-style-type: none"> • BMI ≥ 24 kg/m² • 2 or more diabetes risk factors (based on ADA risk assessment) • Random capillary blood glucose between 110 and 199 mg/dL <p>Socio-demographics:</p> <ul style="list-style-type: none"> • Mean age DPPLI: 56.5 years; control: 60.1 years • 55.4% female • 11.9% African American; 81.5% white 	<p>Design: cluster-randomized trial (N=92)</p> <p>DPPLI:</p> <ul style="list-style-type: none"> • Core curriculum delivered in small group classroom style meetings over 16–20 weeks by trained YMCA staff (CHWs) • Maintenance activities involved monthly, large-group meetings at the YMCA <p>Control:</p> <ul style="list-style-type: none"> • Brief counseling 	<p>Time points:</p> <ul style="list-style-type: none"> • Baseline • 4–6 months after enrollment • 12–14 months after enrollment <p>Anthropometrics:</p> <ul style="list-style-type: none"> • Weight 	<p>4–6 month weight loss:</p> <ul style="list-style-type: none"> • Controls: –1.8 kg (2%) • Intervention: –5.7 kg (6%) <p>12–14 month weight loss:</p> <ul style="list-style-type: none"> • Controls: –1.6 kg (1.8%) • Intervention: –5.7 kg (6%)
Katula et al. [18••]	<p>Primary inclusion criteria:</p> <ul style="list-style-type: none"> • 21 years or older • BMI ≥ 25 kg/m² and ≤ 39.9 kg/m² • Fasting blood glucose between 95 and 125 mg/dL <p>Socio-demographics:</p> <ul style="list-style-type: none"> • Mean age: 57.9 years • 42.5% male • 26% race/ethnicity other than white 	<p>Design: randomized controlled trial (N=301)</p> <p>DPPLI:</p> <ul style="list-style-type: none"> • CHWs led weekly group sessions for 6 months in community settings; two contacts/month during months 7–12 • 3 consultations with Registered Dietitian • DVDs with nutrition/physical activity topics <p>Control:</p> <ul style="list-style-type: none"> • Enhanced usual care • 2 individual sessions with a nutritionist; monthly newsletters with lifestyle change tips and community resources 	<p>Time points:</p> <ul style="list-style-type: none"> • Baseline • 6 months • 12 months <p>Anthropometrics:</p> <ul style="list-style-type: none"> • Weight • Height • BMI • Waist circumference 	<p>6 month weight loss:</p> <ul style="list-style-type: none"> • Controls: –1.15 kg • Intervention: –7.27 kg <p>12 month weight loss:</p> <ul style="list-style-type: none"> • Controls: –1.4 kg • Intervention: –7.1 kg (7.3%)
West et al. [41]	<p>Primary inclusion criteria:</p> <ul style="list-style-type: none"> • BMI ≥ 30 kg/m² • Older adults, aged ≥ 60 years • Able to engage in moderate physical activity • Free of cognitive impairment • Diagnosed with prediabetes, type 2 diabetes, hypertension, or other obesity-related condition <p>Socio-demographics:</p> <ul style="list-style-type: none"> • Mean age: 71.2 years • 84% female • 92% white • 12.7% employed; 80.3% retired or disabled 	<p>Design: cluster-randomized controlled trial (N=228)</p> <p>DPPLI:</p> <ul style="list-style-type: none"> • 12 weekly group sessions delivered by lay health educators (CHWs) in senior centers <p>Control:</p> <ul style="list-style-type: none"> • Attention control group • Received “cognitive training” 	<p>Time points:</p> <ul style="list-style-type: none"> • Baseline • 4 months follow-up (after the 12-week program) <p>Anthropometrics:</p> <ul style="list-style-type: none"> • Weight • Height • BMI 	<p>4 month weight loss:</p> <ul style="list-style-type: none"> • Intervention: –3.7 kg • Controls: –0.3 kg <p>DPPLI group had a 9.7 and 10 times higher odds of achieving $\geq 5\%$ or $>7\%$ weight reduction, respectively, compared to control</p>

ADA American Diabetes Association; BMI body mass index; CHWs community health workers; DPPLI Diabetes Prevention Program lifestyle intervention

Table 2 DPPLI translation studies including CHWs: nonrandomized studies

Study	Sample characteristics	Design and interventions	Weight-related measurement	Weight-related outcomes
Mau et al. [40••]	<p>Primary inclusion criteria:</p> <ul style="list-style-type: none"> • Self-identified Native Hawaiian, Filipino, or other Pacific Islander • 18 years or older • BMI ≥ 25 kg/m² for Native Hawaiians and Other Pacific Islanders; BMI ≥ 23 kg/m² for Filipinos • Able to engage in 150 min of brisk walking/ week and dietary changes to induce weight loss <p>Socio-demographics:</p> <ul style="list-style-type: none"> • Mean age: 49 years • 83% female • 52% Native Hawaiian; 27% Chuukese; 12% Samoan 	<p>Design: pre-and post-test nonrandomized pilot study ($N=239$)</p> <ul style="list-style-type: none"> • CBPR approach with linguistic/cultural tailoring • 8 lessons delivered by peer educators (CHWs) in small groups over 12 weeks in community settings • 4 weekly lessons followed by 4 delivered biweekly for 2 months 	<p>Time points:</p> <ul style="list-style-type: none"> • Baseline • 12 weeks follow-up (within 2 weeks post-program) <p>Anthropometrics:</p> <ul style="list-style-type: none"> • Weight • Height • BMI 	<p>12-week weight loss:</p> <ul style="list-style-type: none"> • -1.5 kg mean change in weight • 26% lost 3% or more of baseline weight • 11% lost 5% or more of lessons baseline weight • Those who attended all lessons 8 had greater mean weight loss (-1.8 kg) than those who completed fewer than 8 (-0.70 kg)
Ruggiero et al. [21••]	<p>Primary inclusion criteria:</p> <ul style="list-style-type: none"> • Glucose value in the normal to prediabetes range; absence of diabetes • BMI >24.9 kg/m² • Aged 18–65 years • Self-identified as Latino • Able to decrease fat intake and walk 150 min/week; low physical activity level <p>Socio-demographics:</p> <ul style="list-style-type: none"> • Mean age: 37.86 years • 92.8% female • 100% Hispanic • 24.6% employed; 40.6% with health insurance 	<p>Design: nonrandomized prospective single group study ($N=69$)</p> <ul style="list-style-type: none"> • CBPR approach to tailor for Latino community, including additional culturally and linguistically tailored materials (eg, recipes) • 16 session core program delivered over 24 weeks followed by 6 monthly maintenance sessions; delivered in Spanish in small groups by CHWs in community settings 	<p>Time points:</p> <ul style="list-style-type: none"> • Baseline • 6 months • 12 months from enrollment <p>Anthropometrics:</p> <ul style="list-style-type: none"> • Weight • BMI • Body fat percentage • Waist circumference 	<p>6 month weight loss:</p> <ul style="list-style-type: none"> • 29% achieved 5% weight loss • 20% achieved 7% weight loss <p>12 month weight loss:</p> <ul style="list-style-type: none"> • 30% achieved 5% weight loss • 16% achieved 7% weight loss • Weight change baseline to 6 months: -4.82 lb • Weight change baseline to 12 months: -2.79 lb
Seidel et al. [22•]	<p>Primary inclusion criteria:</p> <ul style="list-style-type: none"> • Aged 18 years or older • BMI ≥ 25 kg/m²; ≥ 3 components of metabolic syndrome; physician consent to exercise <p>Socio-demographics:</p> <ul style="list-style-type: none"> • Mean age: 54 years 	<p>Design: nonrandomized prospective single-group study ($N=88$)</p> <ul style="list-style-type: none"> • 12 weekly group sessions over 12–14 weeks • Delivered by dietitian and exercise specialist with support from lay health coaches (CHWs) 	<p>Time points:</p> <ul style="list-style-type: none"> • Baseline • 3 months • 6 months from enrollment <p>Anthropometrics:</p>	<p>3 month weight loss:</p> <ul style="list-style-type: none"> • 46.4% achieved 5% weight loss • 26.1% achieved 7% weight loss <p>6 month weight loss:</p>

Table 2 (continued)

Study	Sample characteristics	Design and interventions	Weight-related measurement	Weight-related outcomes
	<ul style="list-style-type: none"> • 84.1% female • 72.7% non-Hispanic white • 59.7% poverty $\leq 200\%$ 		<ul style="list-style-type: none"> • Height • Weight • Waist circumference 	<ul style="list-style-type: none"> • 87.5% sustained 5% weight loss • 66.7% sustained 7% weight loss

BMI body mass index; *CBPR* community-based participatory research; *CHWs* community health workers; *DPPLI* Diabetes Prevention Program lifestyle intervention

with a focus on the weight-related outcomes. Only studies which specifically focused on translation of the DPPLI program were included in this review.

The DEPLOY Model

In the DEPLOY (Diabetes Education & Prevention with a Lifestyle Intervention Offered at the YMCA) study, a YMCA model [12•] was used to translate the DPPLI. This pilot cluster-randomized trial compared a group-based DPPLI delivered at a YMCA to brief counseling alone. A total of 92 participants enrolled in the study, with a mean age of 56.5 years in the DPP group and 60.1 years in the standard advice group, 55.4% female, and 81.5% white. Although differences in age and weight between the control and intervention groups were not significant, it is notable that the control group was more likely to be female and non-white. Participants were recruited from health screenings conducted at two YMCAs. The eligibility criteria included $BMI \geq 24 \text{ kg/m}^2$, two or more diabetes risk factors based on ADA risk assessment, and a random capillary blood glucose of 110 to 199 mg/dL. The DPPLI core program, modified for sustainability in the YMCA, was delivered in small groups over 16 to 20 weeks by trained YMCA staff (CHWs). Monthly maintenance large group sessions were held after the core program. Assessments of weight and clinical measures (eg, HbA_{1c} , total cholesterol) were collected at baseline and at 4 to 6 and 12 to 14 months after study enrollment. The results of this study demonstrated a significant decrease in weight post-intervention, with an average weight loss of 6% in the DPPLI group compared with 2% in the control group. In addition, the weight losses were sustained at 12 months. Statistical adjustments for baseline differences in ethnicity and gender did not change the findings. These findings support the YMCA model as another promising translation model suitable for wide dissemination.

The HELP PD Project

The HELP PD (Healthy Living Partnerships to Prevent Diabetes) project was a community-based DPPLI translation

study [18••]. In this study, the DPPLI was delivered by CHWs who received 36 hours of intensive training and were supervised by dietitians. To examine the impact of this DPPLI translation, a sample of 301 overweight/obese individuals with fasting blood glucose (FBG) of between 95 and 125 mg/dL were randomized to receive either DPPLI or usual care. The primary inclusion criteria for this group were adults over 21 years old, high risk for developing diabetes, no medical contraindications to participate in a lifestyle intervention including unsupervised physical activity and weight loss, $BMI \geq 25 \text{ kg/m}^2$ and $BMI \leq 39.9 \text{ kg/m}^2$, and FBG between 95 and 125 mg/dL following at least an 8-hour fast. The characteristics of the sample were mean age of 57.9 years, 42.5% male, 26% race/ethnicity other than white, and 80% with an education level beyond high school. The enhanced usual care group had two visits with a registered dietitian and was provided with a quarterly newsletter with tips for lifestyle changes. The DPPLI was a 2-year, 24-session, group-based intervention administered through a diabetes education program and delivered by CHWs in community settings (eg, recreation centers, libraries, schools, or churches). All participants in the intervention group received three personalized consultations with a registered dietitian at months 1, 3, and 6. Measurements of fasting glucose, insulin resistance, and adiposity were taken at baseline and every 6 months up to 2 years. The 1-year results indicated that the CHW DPPLI groups achieved and maintained significantly better weight-related outcomes, including weight/BMI and waist circumference, and significantly better improvements in clinical outcomes, including fasting glucose and insulin resistance. The results of this randomized controlled study support a DPPLI translation model with CHWs delivering the lifestyle intervention in groups in community settings through a diabetes education program and under the supervision of dietitians.

The POLI Study

One community-based participatory research (CBPR) study examined a DPPLI translation in a population of Native Hawaiians and Other Pacific Islanders (NHOPI) [40••].

The DPPLI was culturally adapted for NHOPI communities and named the POLI (Pili 'Ohana Lifestyle Intervention). The primary inclusion criteria for this study were self-identified Native Hawaiian, Filipino or Other Pacific Islander, 18 years or older, overweight or obese (BMI ≥ 25 kg/m² for NHOPIs or ≥ 23 kg/m² for Filipinos), and able to follow a behavioral weight loss program that involved 150 min of brisk walking per week and a dietary regimen to achieve weight loss of 1 to 2 lb per week. A total of 239 participants enrolled in POLI and had the following characteristics: mean age of 49 years, 83% female, 52% Native Hawaiian, 27% Chuukese, and 12% Samoan. The intervention was delivered in groups in community settings by trained community peer educators (CHWs). The POLI program included four sessions delivered weekly followed by four sessions delivered every 2 weeks for 2 months for a total of 12 weeks. Assessments were conducted at baseline and within 2 weeks of completing the 12-week program. Significant improvement was found for all clinical measures. The mean weight loss was 1.5 kg, with 11% of participants losing at least 5% of baseline weight. Greater adherence was associated with greater weight loss. This CBPR translation delivered by CHWs with an underserved population showed promise and warrants further study using a controlled design.

The MTC Study

The MTC (Making the Connection) (*¡Conéctate!*) study examined a community-based participatory translation of the DPPLI in a Latino community [21••]. The researchers in this study partnered with the community to tailor, implement, and evaluate a community-based version of the 24-session DPPLI delivered in groups by a CHW. The CHWs participated in a 20-hour DEEP [32] training of trainers and received intensive and experiential training from a multidisciplinary team in the curriculum, leadership skills, behavior change and motivational strategies, and compliance with a research protocol. The CHWs delivered a 1-year DPPLI Vanguard group and received observation, supervision, and skill refinement before leading the translation study lifestyle groups. Participants were recruited from community-based health screenings. A total of 69 participants were enrolled based on the following eligibility criteria: low physical activity level, screening glucose value in the normal to prediabetes range with no current diagnosis of diabetes, overweight/obese (BMI >24.9 kg/m² and <40 kg/m²), not pregnant nor planning to become pregnant during study period, aged 18 to 65 years, Latino, living in the study target communities, and no reported medical restrictions related to the program goals. This was a nonrandomized prospective study using a single-group completely within-subject design. Assessments were conducted at baseline, 6 months,

and 12 months, and included three anthropometric measures (ie, weight/BMI, waist circumference, and body fat). The characteristics of the sample were mean age of 37.86 years, 92.8% female, 100% Hispanic, 40.5% with at least high school diploma, 24.6% employed, and 40.6% with health insurance. The MTC DPPLI was a 1-year program modeled after the DPPLI including a “core” program with weekly sessions that shifted to biweekly and then monthly sessions for the “aftercore” program. The MTC DPPLI intervention was delivered in Spanish in small groups in community settings, such as schools, community hospitals, a cultural center, and a social service facility. The results of this translation study indicated statistically significant improvements across time for all three anthropometric measures (ie, weight/BMI, waist circumference, body fat), particularly at 6 months. The proportion of participants that achieved 5% weight loss and 7% weight loss was 29% and 20%, respectively, at 6 months, and 30% and 16%, respectively, at 12 months. The results of this study support this CBPR CHW translation model as another promising approach to delivering the DPPLI, particularly in a high-risk underserved population. Randomized controlled studies are needed to further examine this CHW model of DPPLI translation.

Pittsburgh Community-Based Model

A DPPLI translation was conducted in a community hospital in an urban medically underserved community in Pittsburgh [22•]. This nonrandomized prospective intervention study used a single-group repeated measures design to test the effectiveness of a community-based DPPLI program. Participants were recruited from community-based screenings in 11 urban medically underserved neighborhoods, representing the primary service area for a community hospital. Eligibility criteria included BMI ≥ 25 kg/m², physician consent to exercise, and at least 3 of 5 components of metabolic syndrome. A total of 88 participants enrolled in the DPPLI program, and their characteristics included mean age of 54 years, 84.1% female, 72.7% non-Hispanic white, 59.7% had an annual household income $\leq 200\%$ below the poverty level, and 77.4% had at least a high school education. Assessments were conducted at baseline, 3 months, and 6 months, and the primary weight measures included anthropometrics (weight/BMI, waist circumference) and laboratory data (eg, glucose). The DPPLI program included 12 weekly group sessions over 12 to 14 weeks and was delivered in a community hospital by a registered dietitian and an exercise specialist with support from two “lay health coaches” (CHWs). The CHWs were trained, along with the team, in delivery of the program. The CHWs were supervised by the professional staff, and their role included

communicating with participants and physician offices, sharing relevant experiences to initiate class discussions, identifying barriers and solutions to promote program engagement and retention, and assisting in study logistics. Improvements were found in weight across time. The percentages who lost at least 5% and 7%, respectively, were 46.4% and 26.1% at 3 months, and the majority sustained their losses at 6 months. When improvement in metabolic syndrome components was examined, similar patterns were observed. This translation study supports a hospital-based translation model that uses a team approach with health professionals leading the groups and CHWs playing a supportive role. Randomized controlled research is also needed to examine this promising model.

Senior Center Model

In another study, the DPPLI was delivered by lay health educators (CHWs) in senior centers with obese older adults [41]. This study used a cluster-randomized control trial design with 228 obese older adults nested within 15 senior centers. The inclusion criteria were obese (BMI ≥ 30 kg/m²), older adults (≥ 60 years), able to engage in moderate exercise, and free of serious memory problems. The total participant characteristics were mean age 71.2 years, 84% female, 92% white, 89% completed high school, 12.7% employed, 80.3% retired or disabled, and mean BMI of 36.1 kg/m². The attention control group received “cognitive training,” which included basic information about how the brain functions: memory processes and how aging and other factors affect these processes, and cognitive strategies to enhance memory functioning. The CHWs received a total of 32 hour of face-to-face training from research staff and participated in weekly telephone supervision sessions. The DPPLI was a 12-session group program led by CHWs in the senior centers. Weight-related measurements were taken at baseline and 4 months after the 12-week program. For the seniors at centers randomized to receive the CHW-led DPPLI groups, the results indicated significantly greater weight loss, and a significantly greater proportion reached either a 5% or 7% weight loss goal (38% and 24%, respectively) compared with those at the control centers (5% and 3%, respectively). Results from this study support this as another promising model of translation with an underserved population.

Conclusions

The important role that CHWs may play in supporting the health of community members has been recognized by national and international groups, such as the World Health Organization [24] and the Centers for Disease Control and

Prevention [42]. In addition, the role they may play in supporting diabetes education, especially in underserved community populations, has been recognized by the AADE [30]. Evidence has been mounting demonstrating their role in community-based outreach, awareness, and support for people with diabetes. Some recent evidence has also emerged demonstrating their promise as members of a multidisciplinary diabetes care team.

As noted in the introduction, the growing epidemic of obesity and diabetes requires urgent, diverse, and broad efforts to have a major impact in these public health challenges. The DPPLI is one efficacious approach to tackling this challenge through weight reduction to help control the risk of type 2 diabetes. Innovative strategies are needed to translate the DPPLI to reach people at risk of diabetes. CHWs represent a motivated group of individuals poised to play a role in supporting the translation of the DPPLI, especially in underserved populations. Six studies were identified in the literature that included CHWs in efforts to translate the DPPLI. These studies and a recent meta-analysis support the promising role that CHWs may play in delivering the DPPLI in community settings and/or working with multidisciplinary health care teams [43]. The DPPLI has been adapted in different ways, but the program goals have remained consistent with the original DPPLI. These DPPLIs have demonstrated promise across a variety of high-risk and underserved populations and diverse medical and community settings.

Although the results to date examining the role of CHWs in DPPLI translation are promising, few have been RCTs. Therefore, further research is needed to examine these promising models using large-scale RCTs. In addition, consistency in outcome measures and assessment points would greatly enhance our interpretation of the findings and promote clearer comparison across studies.

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