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Diabetes Prevention in U.S. Hispanic Adults: A Systematic Review of Culturally Tailored Interventions

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Abstract

Context—Type 2 diabetes, prediabetes, and metabolic syndrome are highly prevalent in Hispanic individuals in the U.S. Cultural adaptations of traditional lifestyle interventions have been recommended to better reach this high-risk population. This systematic review examined the effectiveness of diabetes prevention programs for Hispanics in lowering risk for Type 2 diabetes, as evidenced by a reduction in weight or improvement in glucose regulation.

Evidence acquisition—PubMed/MEDLINE, CENTRAL, Web of Science, and PsycINFO were searched from database inception to June 2016 for studies that evaluated diabetes prevention trials targeting U.S. Hispanic populations. Twelve publications met criteria for inclusion.

Evidence synthesis—Interventions varied substantially in length, rigor, and tailoring strategies. Five of 12 studies were RCTs. Eight studies included entirely or largely (>70%) female samples. All studies were delivered in Spanish and took place in community settings. Nine studies reported significant reductions in weight, and two in glucose regulation, post-intervention or when compared with controls. Effect sizes were small to moderate, study quality was moderate, and attrition was high in most trials. Interventions with the largest effect sizes included one or more of the following adaptations: literacy modification, Hispanic foods/recipes, cultural diabetes beliefs, family/friend participation, structured community input, and innovative experiential learning.

Conclusions—Culturally tailored lifestyle interventions for diabetes prevention appear to be modestly effective in reducing risk for diabetes in Hispanics in the U.S. More studies are needed that utilize randomized controlled designs, recruit Hispanic men, report intervention content and tailoring strategies systematically, and publish participant evaluation and feedback.

CONTEXT

Prevalence of Type 2 diabetes has risen markedly in recent decades. Hispanics/Latinos (hereafter referred to as “Hispanic”) and other racial/ethnic minorities in the U.S. exhibit

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higher prevalence of diabetes than their non-minority counterparts^{1,2}; have poorer glucose control once diagnosed; and experience disparities in quality of life, diabetes-related organ and vascular complications, depression, cardiovascular disease, and mortality once diagnosed.²⁻⁴ Though Hispanic and Hispanic American individuals in the U.S. are a heterogeneous ethnic group, consisting of individuals from multiple background groups (e.g., Mexican, Cuban, Puerto Rican), cardiometabolic risk is a significant concern across Hispanic adults. Twenty-two percent of Hispanic adults have high blood pressure, more than 81% of Hispanic men and 78% of Hispanic women are overweight or obese, and fewer than 16% of Hispanic adults meet federal physical activity guidelines.⁴ Multiple large clinical trials have shown that intensive lifestyle interventions such as the Diabetes Prevention Program (e.g., interventions that provide a structured program of guided changes in dietary intake and physical activity over time) can lead to weight loss and delay or prevent Type 2 diabetes in at-risk individuals.^{5,6} A recent meta-analysis showed that translations of the Diabetes Prevention Program to real-world settings have also been effective in reducing weight and diabetes risk.⁷ These intervention programs have been poorly accessed by racial and ethnic minority groups,⁸ however, which may contribute to disparities in diabetes outcomes. Lifestyle change suggestions provided in these interventions (e.g., going to the gym, healthy food options) may lack relevance or feasibility for individuals with highly constrained incomes and culturally-based food and activity preferences, and the duration of most lifestyle programs (often 12–16 weeks) may be overly burdensome.^{9,10}

In an attempt to more effectively reach high-risk Hispanic individuals, there has been a push in recent years toward the development of “culturally tailored,” “targeted,” or “adapted” diabetes prevention programs that modify content, language, mode of delivery, or other intervention components to improve attendance and outcomes. In 2001, the Office of Minority Health of the U.S. DHHS published the National Standards for Culturally and Linguistically Appropriate Services in Health Care, urging providers to make their services more culturally and linguistically appropriate to minority groups, and mandating such adaptations for recipients of federal funding, in order to increase accessibility and improve quality of care.¹¹ The consideration of culture is widely recognized as a critical component in providing high-quality care to diverse communities and reducing racial and ethnic health disparities. However, the extent to which tailored programs are effective in reducing risk for Type 2 diabetes in Hispanics is unclear. No study has reviewed data on the extent to which programs tailored for Hispanic individuals have modified critical risk reduction outcomes (e.g., weight, glucose) or identified common tailoring strategies, if any, that are associated with efficacy. The authors conducted a systematic literature review to examine all studies that assess effectiveness of targeted or tailored diabetes prevention programs for Hispanic or Hispanic American individuals in the U.S. via outcomes of weight or glucose regulation. The primary aim was to investigate the effectiveness of targeted or culturally tailored diabetes prevention programs for Hispanics in lowering risk for Type 2 diabetes, as evidenced by reduction in weight or improved glucose regulation. As a secondary, exploratory aim, the authors planned to examine whether interventions were effective in changing health behaviors relevant to diabetes risk, such as physical activity and dietary intake, if measured and reported in the included studies. Finally, this review documented the

components of tailoring that were used across studies and attempted to evaluate their association with successful reductions in diabetes risk.

EVIDENCE ACQUISITION

Literature Search

This systematic literature review was conducted and reported in alignment with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.¹² Comprehensive search strategies were designed for electronic databases (PubMed/MEDLINE, the Cochrane Central Register of Controlled Trials [CENTRAL], Web of Science, and PsycINFO) to capture all studies from database inception to June 2016. Searches incorporated medical subject heading (MeSH) and keyword terms in three categories: disease focus, intervention type, and population. For example, the PubMed/MEDLINE search included the following terms: [*diabetes mellitus/prevention and control* (MeSH term) OR *diabetes prevention* (keyword) OR *diabetes risk reduction* (keyword)] AND [*intervention* (keyword) OR *health promotion* (MeSH)] AND [*Hispanic Americans* (MeSH) OR *Hispanic* (keyword) OR *Latin** (keyword)]. Reference lists of included publications were hand searched to identify additional eligible studies. Grey literature (theses, dissertations, conference proceedings) was not included in this search owing to lack of peer review and increased risk of bias.

Study Selection

The following inclusion criteria were used for the selection of publications for this review:

1. The study evaluated a behavioral lifestyle intervention aimed at reduction of risk for Type 2 diabetes via changes in dietary intake and physical activity (e.g., was not a drug-related or passive education intervention, such as reading a pamphlet or viewing videos).
2. The intervention was specifically designed for Hispanic participants (e.g., researchers report using multiple tailoring, targeting, or adaptation strategies).
3. The intervention included either weight or a glucose regulation variable (i.e., fasting glucose, hemoglobin A1c [HbA1c], or oral glucose tolerance test) as an outcome measured both at baseline and post-intervention.

Studies were excluded if participants had a current Type 2 diabetes diagnosis, if the intervention took place outside of the U.S., or if published in a language other than English or Spanish. Studies of interventions for children or adolescents (aged <18 years) and special populations (e.g., severely mentally ill, cancer survivors) were excluded given the unique health context and intervention needs of these individuals.

Data Extraction and Quality Assessment

Two reviewers (authors JM and AG) independently conducted abstract review, data extraction, and data quality appraisal. Screening and inclusion processes are reflected in the flow diagram displayed in Figure 1. Data extraction included the following data points: participant characteristics, study design and setting, intervention variables, theoretical

model, follow-up time, components of tailoring, and selected clinical and behavioral outcomes (mean weight or HbA1c, physical activity, and dietary intake). Discrepancies in inclusion/exclusion or data extraction points between the two reviewers were discussed and resolved. Raw mean differences (D) and standardized effect sizes (d) were calculated for clinical outcomes (weight, HbA1c) in all studies. Raw mean differences were either differences in group mean values or average of individual change scores, whichever was reported in the publication. For single group pre–post effect sizes, pre-intervention mean was subtracted from post-intervention mean and divided by the pre-group standard deviation. Cohen's d was calculated for all comparisons of intervention versus control groups. When necessary, additional information (e.g., mean outcome value, SD) was requested from study authors if not reported in the publication. Within-group effect sizes were calculated using the difference in baseline and post-intervention outcome values. For controlled trials, between-group effect sizes compared intervention and control group outcomes at follow-up assessment. For publications that reported data from multiple follow-up assessments, effect sizes were calculated for the assessment closest to the end of intervention for consistency across studies. Effect sizes were corrected for direction of outcome values so that positive effect sizes indicated improvement/risk reduction. In alignment with Cochran systematic review guidelines,¹³ effect sizes were not combined in a formal meta-analysis due to the heterogeneity of study design, intervention length, and follow-up time across interventions. Components of tailoring and adaptation strategies used across multiple studies are documented in Table 2. Strength of evidence was evaluated using the Effective Public Health Practice Project Quality Assessment Tool (EPHPP, available online at www.ehphp.ca/tools.html). Compared with the Cochrane Collaboration Risk of Bias tool, another commonly utilized tool for assessing quality of data in systematic reviews, the EPHPP has demonstrated higher inter-rater reliability and lower risk of bias.¹⁴

EVIDENCE SYNTHESIS

Study Characteristics

The literature search identified 215 unique publications, 12 of which were included in the final review (Figure 1). Characteristics of the 12 studies are presented in Table 1. Five studies were RCTs, six were single group pre–post uncontrolled trials, and one study utilized a quasi-experimental community comparison group design. Studies were published between 2008 and 2016. One study included the school-aged children of participants¹⁵; only adult/parent data were included this review. Another study recruited Hispanic women with Type 2 diabetes and their adult daughters without a diabetes diagnosis¹⁶; in this case, only data from the adult daughters without diabetes were included. All studies recruited convenience or clinic-referred samples; no random sampling was conducted. Studies varied widely in sample size (N=20–312). Four studies recruited female participants only,^{16–19} and four others were composed of largely (70%) female samples.^{20–23} Participant mean age ranged from 27.8 to 52 years, participants were largely of Mexican descent, and the majority were overweight or obese (BMI >25). Six studies used participant BMI >24 or 25 as an inclusion criterion,^{16,17,22–25} and three studies used elevated HbA1c^{20,22} or prediabetes diagnosis via oral glucose tolerance test¹⁹ as inclusion criteria.

Interventions

All studies evaluated lifestyle change interventions that aimed to reduce risk for Type 2 diabetes, as measured by reduction of weight or HbA1c, an indicator of past long-term (i.e., 2 to 3-month) regulation of blood glucose. In all cases, intervention content focused on increasing physical activity or healthy eating patterns. All interventions utilized in-person, face-to-face delivery of intervention content, and 11 of 12 were delivered by a peer educator (“*promotor/promotora*” in Spanish) or community health worker. However, significant heterogeneity was seen in setting, duration, and content of interventions. Interventions took place in a variety of locations (e.g., community centers, homes, churches, schools), and all were offered in the local communities in which participants lived. Intervention length varied from eight to 24 sessions, with follow-up assessments occurring from 8 weeks (immediate post-intervention) to 1 year post-intervention. The modality utilized by all studies was group educational sessions, with two interventions providing supplemental individual sessions.^{16,24} Few publications included detailed descriptions of intervention content, such as curriculum outlines or lists of addressed health topics. When listed, intervention content focused largely on the following topics: general diabetes education (risk factors, disease information, diagnostic criteria, complications), physical activity (recommended levels, benefits, tracking), nutrition (serving sizes, reading food labels, carbohydrate/fat/sodium content), and participant confidence and self-efficacy to make behavioral changes.

Cultural Tailoring and Adaptation

Wide variation was seen in the amount, type, and approach to adaptation or tailoring within each intervention. Strategies reported for each intervention are listed in Table 2. Some interventions included minimal changes to previously evaluated interventions (e.g., adapting the Diabetes Prevention Program to a community setting in Spanish, with literacy modifications¹⁹), whereas other research groups engaged in a formalized community-based participatory research approach to developing intervention content, and solicited local knowledge and input regarding tailoring strategies. Aggregating across studies, the most common domains of tailoring/adaptation were **language** (delivery in Spanish, all studies), **setting** (community locations, all studies), **delivery** (e.g., peer educator or community health worker versus a nurse or other non-peer health professional, 11 studies). Several studies also incorporated **modifications for literacy** (nine studies), **Hispanic foods and recipes** (seven studies), and **structured community input** (into curriculum content/design, eight studies). Innovative strategies used less commonly in interventions included group trips to a supermarket or garden to practice healthy food selection and purchasing,^{19,24} creation of a *telenovela* (a type of soap opera) video to teach diabetes content,²⁴ social marketing campaign to promote community-level diabetes awareness,²² recruitment of parent-child and mother-adult daughter dyads,^{15,16} and participant-led community walking groups.²³

Clinical Outcomes

The primary outcomes considered in this review were changes in weight (lbs) and HbA1c (%). Mean differences and standardized effect sizes are listed in Table 3, with statistically significant findings indicated by plus (+) sign. All studies measured participant weight; nine reported a statistically significant reduction in mean weight post-intervention or for the

intervention group compared with controls.^{15–17,19,22–26} Five RCTs were included among these^{16,19,22,24,25}; all five reported statistically significant weight loss in intervention versus control participants. Effect sizes for changes in weight were small, however, ranging from 0.01 to 0.32. Of the five studies that examined HbA1c,^{17–19,22,24} two reported significant reductions in mean HbA1c post-intervention,^{22,24} and one of three RCTs reported a statistically significant reduction in HbA1c compared with controls.²⁴ Effect sizes for change in HbA1c ranged from 0.04 to 0.67.

Behavioral Outcomes

Behavioral outcomes included as a secondary, exploratory focus in the review were physical activity (quantity, frequency) and dietary intake (increase in healthy eating or decrease in risk-associated food or eating patterns, such as reduction of high-fat foods). Results for these outcomes are presented in Appendix Table 1. Method and quality of assessment of physical activity and dietary intake varied greatly across studies. In fact, it is unclear whether any single measurement of diet or physical activity was utilized across more than one study. Seven studies examined changes in physical activity, all measured by participant self-report,^{15,18,21–24,26} with some utilizing validated, reliable measures for Hispanic populations (e.g., Global Physical Activity Questionnaire, International Physical Activity Questionnaire, Rapid Assessment of Physical Activity) and others employing study-specific individual physical activity items. Four studies reported significant changes in physical activity levels post-intervention^{15,18,23,26} (Appendix Table 1). Nine studies measured some aspect of dietary intake or nutrition, via participant self-report only,^{15,16,18,21–26} and eight reported significant changes in dietary behaviors due to the intervention.^{15,16,18,22–26} Similar to physical activity, dietary and nutrition patterns were measured in a variety of ways across studies, including reliable and validated assessments such as the Fat-Related Dietary Habits Questionnaire and non-validated measures. Several studies employed study-specific items measuring dietary behavior, or did not report details of measures used. Four studies reported reduction in dietary fat intake,^{16,18,24,25} two reported reduction in sugar consumption/ glycemic load,^{16,22} and three reported increases in consumed fruit and vegetable servings.^{15,16,22,25,26} Given the inconsistency of constructs measured and heterogeneity in measurement method and timeline, effect sizes could not be calculated for these outcomes.

Quality of Evidence

Global evidence quality ratings for each study appear in Table 1. Detailed quality of evidence ratings for study components appear in Appendix Table 2. Following the EPHPP evaluation procedures, studies were rated on the following characteristics and criteria:

1. selection bias, based on the representativeness of the sample and percentage of eligible individuals who agree to participate;
2. study design, with randomized and controlled designs ranking higher in quality than uncontrolled trials;
3. confounders, based on whether relevant confounders were controlled by design or analysis;

4. blinding, judged by whether assessors and participants were aware of the study question/goal;
5. assessment methods, based on the validity and reliability of measures used; and
6. attrition, evaluated by the percentage of withdrawals and dropouts from the study sample.

Global ratings were assigned based on the total number of “weak” ratings a study accumulated across categories (footnotes in Table 1 and Appendix Table 2). Two publications received global ratings of “strong” evidence quality,^{19,24} five studies received global ratings of “moderate,”^{16,20,22,23,25} and five of “weak.”^{15,17,18,21,26} Of the assessed evidence quality domains, included studies most often lost quality rating points for selection bias, as most recruited convenience samples instead of conducting random sampling and had low eligible to enrolled ratios. Several studies received “weak” ratings for attrition due to large numbers of withdrawals and dropouts, and for blinding due to lack of blinding assessors and participants to the study question (or lack of reporting blinding). Ten of 12 studies received “strong” quality ratings for their data collection or assessment methodology,^{15–20,22–25} which was rated based on assessment of the primary outcomes (i.e., weight, HbA1c).

DISCUSSION

Of the 12 interventions included in this review, nine resulted in significant reductions in weight, and two in HbA1c, suggesting that adapted or culturally tailored diabetes prevention interventions for Hispanic individuals may be somewhat effective in reducing diabetes risk indicators. Although only five interventions (38%) were tested using a randomized controlled design, the gold standard methodology for evaluation of health behavior interventions and the strongest evidence for efficacy,^{16,19,22,24,25} all five found that the intervention resulted in weight loss post-intervention, relative to controls. However, only two of these received “strong” evidence quality ratings when multiple aspects of study design and implementation were considered.^{19,24} Two RCTs measured long-term (6-month) clinical outcomes and reported mean decreases in weight of 5.5 lbs²² and 8.4 lbs,¹⁹ respectively. A large gender bias was evident, as eight of 12 samples were 70% or more female.^{16–23} Considered together, these details suggest that although initial evidence for efficacy exists, the support for long-term efficacy of tailored diabetes prevention interventions for Hispanics, especially men, is limited. Additional trials are needed that utilize rigorous study designs, incorporate men, and follow participants longer post-intervention.

Of note, though intervention effect sizes were typically small, the linear, incremental relationship of weight loss and HbA1c reduction with cardiometabolic risk has been established, such that even very small shifts in these outcomes (i.e., a change in HbA1c of 0.5%) can correspond to clinically meaningful changes in disease risk. A meta-analysis on this topic found that the risk for incident diabetes increased markedly across the HbA1c range of 5.0 to 6.5%,²⁷ and a 1–percentage point increase in HbA1c has been shown to be associated with a 20%–30% increase in risk of cardiovascular events and mortality.²⁸

Studies addressing secondary outcomes of interest raise concerns about methodologic quality, particularly relating to the inconsistency in measured variables and method of measurement. Four studies reported significant changes in self-reported physical activity levels^{15,18,23,26} and eight studies reported significant changes in some aspect of dietary behavior.^{15,16,18,22–26} Considering only the strongest evidence provided by the four RCTs that measured behavioral outcomes, all four interventions produced significant changes in dietary intake, but only two measures physical activity outcomes, and neither resulted in a significant increase in physical activity. In all cases, the achieved changes were modifications to one aspect of dietary behavior (e.g., reduction in percentage of dietary calories from fat, drinking fewer sugary beverages), without accomplishing the comprehensive dietary modifications or recommended physical activity levels needed to reduce risk substantially over time. In addition, all measures of exercise and diet were self-reported by participants with no triangulation by objective measures such as accelerometry. Participants in one study were given accelerometers to track walking time; unfortunately, no data were collected from the use of this equipment. Objective measurements of diet and physical activity are known to be time and resource intensive and may have been out of the scope of the relatively small studies included in this review. Nonetheless, their absence represents a significant weakness in this small but growing literature. Further, the frequent use of study-specific and non-validated measures in the reviewed studies is not optimal, as the risk of assessment bias and the inability to compare across studies weakens the authors' ability to measure achieved effects.

Cultural Tailoring

Multiple tailoring strategies were used in each study in an attempt to more effectively reach at-risk Hispanic individuals. All interventions were offered in Spanish and took place in community settings near participants' homes, and all but one¹⁹ were delivered by peer educators or community health workers. The majority (nine studies) reported modifications for low literacy, eight studies included structured community input in intervention design, and seven studies addressed culturally based diabetes beliefs or knowledge (references in Table 2). Unfortunately, no tailoring strategies were directly measured or linked to clinical outcomes by study authors, and no studies compared a tailored intervention to an equivalent non-tailored approach. Of the five studies with the strongest intervention effect sizes for weight and HbA1c,^{17,19,22,24,25} four made modifications for low literacy and were led by peer educators, and all included one or more of the following: Hispanic foods/recipes, cultural diabetes beliefs, family/friend participation, structured community input, and innovative hands-on strategies such as learning events in a grocery store or community garden.

Participant Evaluation

Community-based participatory research and other community-engaged research approaches to health behavior interventions often include post-intervention participant evaluations to solicit feedback on intervention acceptability and feasibility. Critical insight into barriers to and facilitators of behavior change and perceived benefit of tailored components may be gained in this type of evaluation and, when published, enable the research community to learn deeply from each conducted intervention. For example, Ockene et al.²⁴ reported

participant feedback indicating that major modifiable barriers to dietary change were stress (34% reported), lack of willpower (55%), and home food environment (30%), while major personal barriers for increased physical activity were time constraints (48%), fatigue (27%), and lack of motivation (29%). At least four additional included studies conducted focus groups or another form of participant evaluation; however, very little data were published from these processes. Of the feedback that was provided, participants reported the following barriers: spousal demands and gender roles of women, including the need to be at home during evening hours,^{15,18} and the complexity of making nutritional or activity changes in a multigenerational household or family.¹⁵ Authors publishing new studies should strongly consider inclusion of a detailed report of participant evaluation outcomes, including assessment of benefit and usefulness of tailoring strategies. Investigators planning new interventions would benefit greatly from the aggregation of participant feedback across various study types and modalities.

Limitations

This is the first systematic review to synthesize outcomes from tailored lifestyle change–focused diabetes prevention interventions for Hispanic individuals. The review followed guidelines of the PRISMA statement for the reporting of systematic reviews. A comprehensive search strategy was utilized across multiple databases, inclusion and exclusion details were reported in a concise flow diagram (Figure 1), and two independent coders verified data extraction. Detailed intervention characteristics were reported in addition to outcomes, including aspects of cultural tailoring, which have rarely been compared or tracked across diabetes prevention studies. Limitations of the review are the inclusion of small, uncontrolled trials of moderate to low quality, which provide relatively weak evidence for or against the efficacy of culturally tailored interventions as a whole. As always, some completed interventions may not have been included because of publication bias. An additional limitation is the potential lack of generalizability of these results to men and across heterogeneous Hispanic communities, which can differ widely in background, acculturation, and geographic location. The majority of interventions included primarily Mexican American individuals, included more women than men, and incorporated no older or aging adults.

CONCLUSIONS

Culturally tailored diabetes prevention interventions for Hispanics appear to be modestly effective in reducing risk for Type 2 diabetes via reduction of weight and HbA1c. Evidence is weaker for the ability of these interventions to influence physical activity and dietary intake. A major limitation in this intervention literature, as a whole, is the exclusive use of self-report and the frequent use of study-specific, non-validated measures to assess behavior change. The completion of 12 community-based prevention trials is a partial indication that conducting tailored lifestyle interventions in Hispanic communities may be feasible; however, high attrition rates in many studies signal the need for further adaptation and innovative intervention designs or delivery methods. Systematic documentation and reporting of intervention content, tailoring processes, participant evaluations, and attrition are vital to and will enable future interventions to build on previous work. In addition to

simple tailoring strategies, new interventions must take care to address reported barriers to intervention engagement, such as stress/fatigue, home food environments and family eating habits, time constraints, and lack of motivation. As the primary goal of cultural tailoring is to increase access and quality of care for at-risk minority groups, reasons for consent refusal, withdrawal, dropout, and missed sessions must be documented and published. When tailoring is conducted, efforts should be taken to measure effectiveness by linking tailoring strategies to either quantitative or qualitative outcomes. Participant feedback should be solicited regarding the acceptability and feasibility of intervention components, including any tailoring or adaptation, and published along with quantitative intervention results. Rigorous, high-quality RCTs with longer-term follow-up periods and more male participants are needed to comprehensively address the long-term effectiveness in reducing risk for diabetes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1. Flow diagram: screening and inclusion of publications

^aOutcomes which were inclusion criteria for this review (weight, HbA1c).

^bSamples of individuals with specific diagnoses (e.g., schizophrenia) who have unique intervention needs.

^cPublication described methods but not outcomes of study.

Characteristics of Tailored Diabetes Prevention Interventions for Hispanics

Table 1

Authors (Year)	N, Mean age, Sex (M/F)	Study design and setting	Participants ^a	Intervention (Length; modality; educator type)	Control	Measurement/Follow-up times	Theoretical model	EPHPP Global rating ^b
Buckley et al. (2015)	N: 192 M age: 49.8 M/F (73% F)	UPP; Providence, RI; Clinic and community settings	Low income adults, 89% Hispanic, with or at risk for metabolic syndrome	8 weekly sessions; group face-to-face delivery; peer educator	None	End of intervention, 1–7m	SCT	2
Coleman et al. (2010)	N: 82 ^c M age: 37.5 M/F	UPP; San Diego, CA; School setting	Low income Hispanic adults with child at risk for T2DM	10 weekly sessions; group face-to-face delivery; NR	None	End of intervention	TPB, HBM, SLT, EM	3
Gutierrez et al. (2014)	N: 76 ^d Age: 63% aged 45–64 M/F	UPP; New York City, NY; Church-based	Low income Hispanic adults in Spanish-speaking churches	12 weekly sessions; group face-to-face delivery; peer educator	None	End of intervention, 6m	CBPR	3
Millard et al. (2011)	N: 81 M age: 35 M/F (97.5 % F)	Quasi-experimental; Texas-Mexico border; Homes	Low-income Mexican American adults	8-weekly sessions; group face-to face delivery; peer educator	Non-randomized comparison group	End of intervention	CBPR, TTM, EM	3
O'Brien et al. (2015)	N: 20 M age: 44.5 F only	UPP; Philadelphia, PA; Community setting	Low income Hispanic women with prediabetes, BMI 25, ADA risk score 5	24 sessions over one year; group face-to-face delivery; peer-educator	None	End of intervention	NR	3
Ockene et al. (2012)	N: 312 M age: 52 M/F	RCT; Lawrence, MA; Community center	Low income Dominican (60%) and Puerto Rican (40%) adults age 25 or older, BMI >24	3 individual and 13 group sessions over 12 months; face-to-face delivery; peer educator	UC	End of intervention	SCT, patient-centered counseling	1
Parikh et al. (2010)	N: 99 M age: 48 M/F (85% F)	RCT; New York City, NY; Community setting	Low income adults (89% Hispanic) with prediabetes, BMI 25	8 sessions over 10 weeks; group face-to-face delivery; peer educator	WL	End of intervention, 6m, 12m	CBPR, SCT	2
Philis-Tsimikas et al. (2014)	N: 84 M age: 31.9 F only	UPP; San Diego, CA; Community clinic	Low income Hispanic women, 88% born in Mexico, age 18–45, history of GDM in pregnancy	8 weekly sessions; group face-to-face delivery; peer educator	None	End of intervention, 6m	CBPR, SCT	3
Ruggiero et al. (2011)	N: 69 M age: 37.9 M/F (93% F)	UPP; Chicago, IL; Community setting	Hispanic adults age 18–65, BMI 24.9	16 weekly sessions and 6 monthly sessions; group face-to-face delivery; CHWs	None	End of weekly sessions (6m), End of intervention	CBPR, TTM	2
Sorkin et al. (2014)	N: 89 ^e M age: 27.8 F only	RCT; Central California; Community setting	Mexican American mother-daughter dyads, BMI 25, ADA risk score 10	16 week program; 4 group face-to-face visits, 8 home visits, 4 booster telephone calls; CHWs	Information control (mailed educational materials)	End of intervention	NR	2
Van Name et al. (2016)	N: 122 M age: 43 F only	RCT; New Haven, CT; School setting	Women with prediabetes, 90% Hispanic	14 week modified DPP; group face-to-face visits; nurse practitioner	UC	End of intervention, 1y	NR	1

Authors (Year)	N, Mean age, Sex (M/F)	Study design and setting	Participants ^a	Intervention (Length; modality; educator type)	Control	Measurement/Follow-up times	Theoretical model	EPHPP Global rating ^b
Vincent et al. (2014)	N: 96 M age: 50.9 M/F	RCT; Arizona; Community setting	Mexican American adults 25 and older w/BMI 25, ADA risk score 10	8 weekly sessions; 2 monthly sessions; group face-to-face delivery; CHW	Attention control (in-person educational materials)	End of weekly sessions (8w), 5m	SCT	2

^aIf specific Hispanic background is reported (e.g., Mexican, Cuban) this is noted in table.

^bEPHPP, Effective Public Health Practice Project Quality Assessment, global ratings defined as 1=Strong (no weak ratings), 2=Moderate (one weak rating), 3=Weak (two or more weak ratings).

^cParent subset of sample.

^dHispanic subset of sample.

^eAdult daughter subset of sample (individuals without diabetes diagnosis).

ADA, American Diabetes Association; CBPR, Community-Based Participatory Research; CHW, community health worker; DPP, Diabetes Prevention Program; EM, Ecological Model; GDM, Gestational Diabetes Mellitus; HbA1c, glycosylated hemoglobin A1c; HBM, Health Belief Model; NR, not reported; SLT, Social Learning Theory; SCT, Social Cognitive Theory; T2DM, type 2 diabetes mellitus; TPB, Theory of Planned Behavior; TTM, Transtheoretical Model; UC, usual care; UPP, uncontrolled pre-post study; WL, waitlist.

Reported Strategies Utilized in Tailoring Interventions to Hispanic Individuals

Table 2

Authors (Year)	Hispanic food/recipes	Spanish language delivery	Literacy modification ^a	Community setting	Cultural diabetes beliefs	Family or friend participation	Structured community input ^b	Peer-led
Buckley et al. (2015)	NR	Yes	Yes	Yes	NR	No	NR	Yes
Coleman et al. (2010)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gutierrez et al. (2014)	NR	Yes	Yes	Yes	NR	Yes	Yes	Yes
Millard et al. (2011)	Yes	Yes	NR	Yes	NR	Yes	Yes	Yes
O'Brien et al. (2015)	NR	Yes	NR	Yes	NR	No	Yes	Yes
Ockene et al. (2012)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parikh et al. (2010)	Yes	Yes	Yes	Yes	NR	No	Yes	Yes
Philis-Tsimikas et al. (2014)	NR	Yes	Yes	Yes	Yes	No	Yes	Yes
Ruggiero et al. (2011)	Yes	Yes	Yes	Yes	NR	No	Yes	Yes
Sorkin et al. (2014)	Yes	Yes	NR	Yes	NR	Yes	NR	Yes
Van Name et al. (2016)	NR	Yes	Yes	Yes	NR	Yes	NR	No
Vincent et al. (2014)	Yes	Yes	Yes	Yes	Yes	No	NR	Yes
Total studies	7	12	9	12	4	6	8	11

^aModification for low literacy levels;

^bCommunity-based participatory research method, community advisory committee, focus groups, or other organized community input in program/curriculum development.
NR, not reported

Table 3

Raw Mean Differences and Effect Sizes for Primary Clinical Outcomes

Outcome	Study	Raw mean difference (D)	Effect size (<i>d</i>) ^a	95% CI of effect size
Weight		Pounds (lbs)		
Pre v. post intervention				
	Buckley et al. (2015)	-3.60	0.08	-0.17, 0.33
	Coleman et al. (2010) ^{+b}	-1.50	0.07	-0.39, 0.51
	Gutierrez et al. (2014) ^{+c}	-3.07	0.07	-0.23, 0.41
	Millard et al. (2011)	-1.17	0.03	-0.42, 0.48
	O'Brien et al. (2015) ⁺	-10.80	0.23	-0.40, 0.85
	Ockene et al. (2012) ⁺	-2.50	0.08	-0.15, 0.31
	Parikh et al. (2010) ⁺	-7.20	0.34	-0.06, 0.81
	Philis-Tsimikas et al. (2014)	+0.36	-0.01	-0.32, 0.30
	Ruggiero et al. (2011) ⁺	-4.82	0.18	-0.08, 0.59
	Sorkin et al. (2014) ^d	-4.60	0.15	-0.24, 0.53
	Van Name et al. (2016) ^d	-8.35	0.15	-0.20, 0.51
	Vincent et al. (2014) ⁺	-10.29	0.25	-0.20, 0.82
Intervention v. control group				
	Millard et al. (2011) ^e	-6.23	0.18	-0.26, 0.62
	Ockene et al. (2012) ⁺	-4.10	0.08	-0.15, 0.31
	Parikh et al. (2010) ⁺	-1.24	0.05	-0.42, 0.51
	Sorkin et al. (2014) ⁺	-5.20	0.14	-0.28, 0.57
	Van Name et al. (2016) ^{+f}	-16.60	0.32	-0.04, 0.67
	Vincent et al. (2014) ⁺	-4.68	0.12	0.55, 1.04
Hemoglobin A1c (HbA1c)				
		HbA1c %		
Pre v. post intervention				
	O'Brien et al (2011)	-0.10	0.50	-0.15, 1.13
	Ockene et al. (2012) ⁺	-0.10	0.30	0.07, 0.53
	Parikh et al. (2010) ⁺	-0.30	0.67	0.31, 1.21
	Philis-Tsimikas et al. (2014) ^{d,g}	-0.06	0.19	-0.13, 0.49
	Van Name et al. (2016) ^d	-0.04	0.11	-0.26, 0.48
Intervention v. control group				
	Ockene et al. (2012) ⁺	-0.07	0.17	0.06, 0.40
	Parikh et al. (2010)	-0.01	0.04	-0.43, 0.51
	Van Name et al. (2016) ^d	-0.12	0.33	-0.04, 0.71

Notes: For studies that reported data on multiple follow-up assessments, D and *d* were calculated for follow-up time closest to end of intervention for consistency across studies.

⁺ Change (pre- to post-intervention) or comparison (intervention to control group) was statistically significant.

^a Effect sizes were corrected for direction of outcome values so that positive effect sizes indicate improvement/risk reduction.

^b Parent subsample.

^c Hispanic subsample.

^d Significance level of this change/comparison was not reported.

^e Quasi-experimental design, not RCT

^f Significance of comparison of raw follow-up weight between intervention and control group was not reported but intervention group lost significantly more weight than control group.

^g Significant *increase* in HbA1c is reported at subsequent (6 v. 3 months) follow-up assessment.