RESEARCH ARTICLE

# Impact of Peer Nutrition Education on Dietary Behaviors and Health Outcomes among Latinos: A Systematic Literature Review

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## ABSTRACT

**Objective:** This systematic review assesses the impact of peer education/counseling on nutrition and health outcomes among Latinos and identifies future research needs.

**Design:** A systematic literature search was conducted by: (1) searching Internet databases; (2) conducting backward searches from reference lists of articles of interest; (3) manually reviewing the archives of the Center for Eliminating Health Disparities among Latinos; (4) searching the *Journal of Nutrition Education and Behavior*; and (5) directly contacting researchers in the field. The authors reviewed 22 articles derived from experimental or quasi-experimental studies.

**Outcome Measures:** Type 2 diabetes behavioral and metabolic outcomes, breastfeeding, nutrition knowledge, attitudes and behaviors.

**Results:** Peer nutrition education has a positive influence on diabetes self-management and breastfeeding outcomes, as well as on general nutrition knowledge and dietary intake behaviors among Latinos.

**Conclusions and Implications:** There is a need for longitudinal randomized trials testing the impact of peer nutrition education interventions grounded on goal setting and culturally appropriate behavioral change theories. Inclusion of reliable scales and the construct of acculturation are needed to further advance knowledge in this promising field. Operational research is also needed to identify the optimal peer educator characteristics, the type of training that they should receive, the client loads and dosage (ie, frequency and amount of contact needed between peer educator and client), and the best educational approaches and delivery settings.

**Key Words:** acculturation, behavioral change theory, breastfeeding, community health worker, diabetes, EFNEP, Food Stamp Nutrition Education Program, Hispanic, Latino, peer

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## INTRODUCTION

Latinos are the largest minority group in the United States, accounting for over 12% of the population, and they are expected to be nearly 25% of the population by 2050. (Although the terms Latino and Hispanic are often used interchangeably in the literature, the authors will refer to this ethnic group solely as Latino.) Over 40% of Latinos are foreign born, with almost half residing in California and Texas. Latinos represent over 20 different countries of origin from Central America, South America, the Caribbean, and Europe. Over 22% of Latinos live in poverty, compared with 8.2% of non-Latino white individuals. Contributing to poor socioeconomic status are higher unemployment rates, lower-status employment, and lower educational attainment among Latinos compared to non-Latino white individuals.[1,2]

Latinos have less access to nutritionally adequate and safe food. Compared to 7.8% of non-Latino white individuals, almost 20% of Latinos are food insecure.[3] Food insecurity has been linked to poor dietary quality, low quantity

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of food, and overweight/obesity. The high incidence of risk factors and chronic diseases among Latinos including obesity, type 2 diabetes and cardiovascular disease[4-6] is exacerbated by lower physical activity levels compared to the rest of the population.[7,8]

## Peer Educators/Community Health Workers

Community health workers (CHWs) have been defined as "community members who work almost exclusively in community settings and serve as connectors between health care consumers and providers to promote health among groups that have traditionally lacked access to adequate care."[9,10] In the area of nutrition education, the term "peer educator" is commonly used. In the public health literature, the term "community health worker" has become the term of choice, although other terms such as *promotora* are also employed. When describing studies in this review, the authors use the term as reported in the original article.

Community health workers are expected to come from communities of the same socioeconomic status as those they serve, and to have similar cultural and social life experiences as their target clients. The nomenclature used to describe CHWs varies greatly in the scientific literature. Community health workers have been referred to as *promotoras*, *lay health workers*, *community health advisors*, *paraprofessionals*, *patient navigators*, *outreach workers*, *aides*, *peer educators*, and *peer counselors*, without having clear, specific definitions of these terms. The term used does not appear to be solely a function of the discipline studied or tasks performed.

Ideally, CHWs should have experienced a similar condition (eg, diabetes) or practiced the same behavior (eg, breastfeeding) that they are addressing and/or should have provided key support to a close friend or relative with the condition or practicing the behavior of interest.[9-12] The Chronic Care Model[11] posits that CHWs play a crucial role linking communities with the health care system. Community health workers can perform multiple tasks, including disease and case management, the simple transfer of health information, support with medical appointments (eg, making appointment, transportation, presence during appointment), and support for health promotion.[12]

The documentation of the use of paraprofessionals to deliver social and health services in the United States began in the 1960s. Indeed, the use of nutrition education paraprofessionals was formally institutionalized through the creation of the Expanded Food and Nutrition Education Program (EFNEP) in the early 1960s[13] and has greatly expanded through the Food Stamp Nutrition Education Program (FSNE).[14] In developing countries, CHWs have been and continue to be used extensively to address diverse problems including infant mortality and corresponding causal factors (malnutrition, measles and other communicable diseases, diarrhea, respiratory infections), as well as human immunodeficiency virus (HIV), tuberculosis, and malaria in the general population.[10,15] Demonstration projects and small-scale programs in the United States and other developed countries have shown that CHWs are effective at improving diverse outcomes including infant feeding, immunizations, HIV prevention/self-management, diabetes self-management, and breast cancer screening rates.[10,15,16] However, the impact of peer nutrition educators has not been systematically reviewed.

A recent report from a conference on peer-led approaches to dietary change in the United Kingdom reviewed 3 studies grouped into 3 categories: (1) older people living in shelters; (2) mother and infants (emphasis on weaning foods); and (3) individuals with diabetes.[17] All studies targeted low-income individuals. The author concluded that these peer-led interventions can have positive impacts on knowledge, confidence, and attitudes, and small improvements in diet change. However, this conclusion should apply only to the infant feeding study as there were no positive results reported from the diabetes and elderly studies. For the latter 2 studies, the internal validity is highly questionable because of high attrition rates and limited statistical power. There are no published reviews addressing the effectiveness of CHWs who deliver nutrition education to Latinos. However, a systematic review published over a decade ago evaluated the impact of peer nutrition education. These findings are summarized in the following section.

## Impact of Nutrition Education

In 1995 Contento et al examined the effectiveness of nutrition education at improving knowledge, attitudes, and behaviors across the life span.[13] Their review included 217 experimental or quasi-experimental studies with adequate documentation of instrument reliability and validity. The authors included a chapter on the impact of training of paraprofessionals (EFNEP and WIC nutrition aides, school food service staff) and professionals (school teachers, nutritionists, health professionals) on their nutrition education effectiveness. Based on 2 controlled studies,[18,19] the authors concluded that well-developed training programs are effective at increasing paraprofessionals' general nutrition knowledge and breastfeeding knowledge, attitudes, and self-efficacy (for teaching breastfeeding). The review strongly supports a positive impact of paraprofessionals on nutrition knowledge, attitudes, and behaviors of target audiences.[13] However, little emphasis was placed on Latino target audiences, which is understandable since the major growth of the Latino community nationwide is relatively recent and few studies were available at the time when their review was published.

## Objectives

The objectives of this systematic review are to: (1) assess the impact of peer education/counseling on type 2 diabetes, breastfeeding, and other nutrition knowledge, attitudinal, and behavioral outcomes among Latinos; (2) discuss the

policy implications of findings; and (3) identify gaps in knowledge and future research needs. This review covers studies based on federal nutrition education programs (EFNEP and FSNE), as well as demonstration nutrition education programs.

## METHODOLOGY

A systematic literature search (Figure 1) was conducted by: (1) searching Internet databases (PubMed); (2) conducting backward searches using reference lists from articles of interest; (3) manually reviewing the archives of the Center for Eliminating Health Disparities among Latinos (CEHDL); (4) searching the *Journal of Nutrition Education and Behavior*; and (5) directly contacting researchers in the field. The PubMed search was conducted using the following key words and combinations: Latino(s), Hispanic(s), community health worker(s), peer(s), educator(s), peer education, promotora(s), promoter(s), diabetes, nutrition, la cocina saludable, salud para su corazón, su corazón su vida, your health your life, partner(s) in health, compañeros en salud, EFNEP, FSNE, and breastfeeding. For the purpose of this review, nutrition education is defined as "any set of learning experiences designed to facilitate the voluntary adoption of eating and other nutrition-related behaviors conducive to health and well being."[13] Nutrition education impact studies were included if they met the following criteria: (1) experimental or quasi-experimental design; (2) include Latino-specific results or a predominantly Latino study population (> 60%); (3) use of reliable and valid scales; (4) nutrition education intervention(s) clearly described; (5) published since 1994; and (6) conducted in the United States. A Cronbach $\alpha$ of at least 0.85 was established a priori as a criterion for assessing internal validity of scales. Reliability was assessed based on intracorrelation coefficients of repeated scale applications using preset criteria of an $r$ of at least 0.35 and a $P$ value $< .05$.

All abstracts of articles generated from the database searches were reviewed by community nutrition academic and agency experts (ie, the authors of this paper) to identify those that met the inclusion criteria. Of the 87 articles initially identified for full review, 65 were eliminated (Table 1). Thus, this review is based on 9 diabetes articles, 5 breastfeeding promotion articles, 3 EFNEP articles, and 5 articles presenting four nutrition education demonstration programs (Tables 2-5). No FSNE studies met the inclusion criteria.

### Analyses

Each article was assessed for the internal and external validity of the study as well as for the behavioral theory base (or lack thereof) of the intervention. Internal and external validity were assessed following the guidelines recommended by Jekel et al.[20] The collective interpretation of

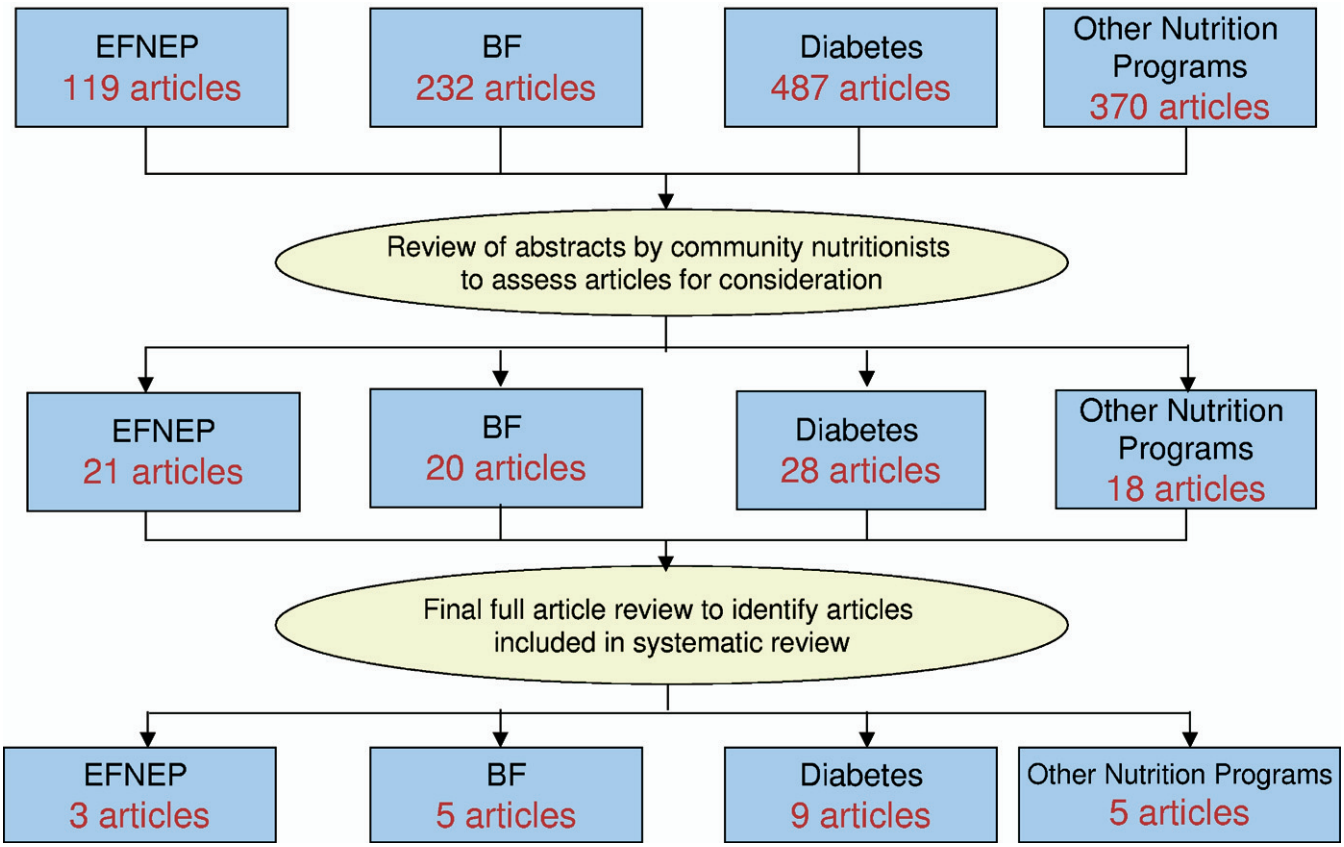


**Figure 1.** Systematic Literature Review Process. BF, breastfeeding; EFNEP, Expanded Food and Nutrition Education Program.

**Table 1.** Exclusionary Factors for Inclusion in Review

| Reasons | Number of Articles Excluded | | | |
|---|---|---|---|---|
| | **Diabetes (n = 19)*** | **Breastfeeding (n = 15)** | **EFNEP (n = 18)** | **Other Nutrition Programs (n = 13)** |
| Latinos were small percentage of sample | 2† (57, 58)‡ | 7 (59-65) | 9 (36-38, 41, 44, 56, 66-68) | 5 (69-73) |
| Used other health professional rather than peer counselors/ community health workers | 1 (74) | 2 (75, 76) | — | — |
| Article does not report results using an experimental or quasi-experimental design (ie, process evaluation article, study description article) | 6 (77-82) | 2 (83, 84) | — | 5 (85-89) |
| No Latinos included in sample | — | 1 (90) | 1 (91) | — |
| Ethnic composition of population sample not defined | — | — | 5 (42, 43, 92-94) | 2 (95, 96) |
| Publication available only as conference abstract | — | — | 1 (97) | 1 (98) |
| Intervention did not include nutrition education | 2 (99, 100) | — | — | — |
| Intervention was not specific to diabetes management | 5 (51, 101-104) | — | — | — |
| Promotoras/community health workers were not involved in diabetes nutrition education instruction | 2 (105, 106) | — | — | — |
| Did not involve community health workers | 1 (107) | 1 (108) | — | — |
| Could not locate articles | — | — | 2 (109, 110) | — |
| Incomplete data for Latinas | | 1 (111) | | |
| Insufficient data to assess study | — | 1 (112) | — | — |

— Indicates that was not a reason for exclusion of an article within the section.
*Indicates the number of articles excluded per section.
†Indicates the number of articles excluded per reason.
‡References.
EFNEP, Expanded Food and Nutrition Education Program.

study findings was the product of a consensus process involving all authors.

## RESULTS

### Diabetes Peer Counseling

Among Latinos, implementing lifestyle modifications to follow current diabetes self-management recommendations is often challenging.[21] Moreover, the lack of culturally competent diabetes education programs that incorporate appropriate language, beliefs, values, costumes, and food preferences hinders the efficacy of existing programs. An emerging approach to improve self-management has been the incorporation of CHWs as part of the diabetes care team. Although several projects are already following this strategy, only those in which CHWs were involved in nutrition education are included herein. Trials that followed a randomized design will be reviewed first, followed by quasi-experimental interventions.

**Randomized trials.** Two randomized trials have been conducted targeting individuals of Puerto Rican[22] and Mexican[23] origin. Corkery et al recruited 64 Latino patients, primarily of Puerto Rican origin, newly referred to a

**Table 2.** Impact of Peer Nutrition Education Among Latinos with Type 2 Diabetes

**Randomized Trials**

| Reference | Sample | Design/Measures | Intervention/Theory | Results | Comments |
|---|---|---|---|---|---|
| Corkery et al[22] | New York, New York<br>64 Hispanic patients primarily of Puerto Rican origin; 40 (63%) completed study<br>newly referred to diabetes management clinic for education<br>> 20 y old | Randomized<br>- CHW (n = 30)<br>- control (n = 34)<br>Pre-/post- knowledge test<br>Outcomes:<br>- program completion | All participants enrolled in a diabetes education program<br>Additional support by CHW as liaison with medical providers, to remind about upcoming appointments, and to reinforce self-care instructions<br>No behavioral change theory specified | Forty participants completed education program<br>Greater diabetes education program completion among participants with CHW (80% vs 47%; $P = .01$)<br>No statistical difference in knowledge, lifestyle behaviors, or metabolic outcomes by CHW assignment | Possible bias:<br>- selection (convenience sample)<br>- self-report<br>Possible lack of statistical power<br>No follow-up to participants who did not complete education program<br>Main outcome was program completion; no clinical outcomes |
| Lujan et al.[23] | Texas-Mexico border<br>Mexican Americans<br>150 patients > 40 y with type 2 diabetes<br>Exclusions:<br>diabetes complications interfering with class participation | Randomized controlled trial:<br>- intervention<br>- usual care<br>Baseline, 3- and 6-month data collection<br>Survey:<br>- acculturation<br>- diabetes knowledge<br>- health beliefs<br>$Hgb_{A1c}$ | Culturally specific 6-month intervention<br>8 weekly 2-h group classes<br>Telephone follow-up calls<br>Behavior change postcards mailed biweekly for 16 wks<br>Community empowerment theory | $Hgb_{A1c}$ decreased (0.45%) for intervention group and increased (0.30%) for control group. Mean changes were significantly different ($P < .001$)<br>Greater change in diabetes knowledge score with intervention ($P < .002$)<br>No change in patients' belief in their ability to manage diabetes | Extensive training for promotoras<br>Unknown extent of nutrition education, but classes met ADA's diabetes education curriculum guidelines |

**Quasi-experimental Trials**

| Reference | Sample | Design/Measures | Intervention/Theory | Results | Comments |
|---|---|---|---|---|---|
| *Education* | | | | | |
| Culica et al[30] | Dallas, Texas<br>92 diabetes patients, >18 y<br>Exclusions:<br>- advanced diabetes complications<br>- pregnancy<br>- unstable blood pressure | Pre-/post- evaluation<br>Clinical data:<br>- $Hgb_{A1c}$<br>- Blood pressure<br>- BMI<br>Patient participation rates | Community health worker-led:<br>- three 1-h visits and quarterly follow-up visits (up to 7 h over 1 program year)<br>- individual case management<br>- personalized meal planning<br>- education (nutrition, diabetes complications, physical activity, medication compliance)<br>- glucometer and test strips | Significant decrease in $Hgb_{A1c}$ (-1.08%, $P < .01$)<br>No change in BMI or blood pressure | Patients of all ethnic backgrounds enrolled; 78% of participants were Mexican American<br>No control group<br>One-to-one education<br>$Hgb_{A1c}$ available only for 55 patients<br>Small sample size; potential lack of statistical power |
| Philis-Tsimikas et al[28] | San Diego County, California<br>Adults (18-80 y) with type 1 and type 2 diabetes<br>Exclusions:<br>- pregnancy<br>- severe medical conditions<br>- poor short-term prognosis<br>- serum creatinine >3.5 mg/dL<br>- active alcohol or drug abuse<br>Project Dulce group (n = 153; 72% Latino)<br>Control group (n = 76; 69% Latino): patients referred to but not enrolled in Project Dulce | Pre-/post- 1-y program participation evaluation<br>No random assignment<br>Measures:<br>- $Hgb_{A1c}$<br>- blood pressure<br>- lipid profile<br>- diabetes knowledge<br>- treatment satisfaction | 12 months of nurse case management (mean of 8 visits/y)<br>- based on Staged Diabetes Management protocols for glucose, lipids and hypertension management<br>Peer-educator led group-based classes:<br>12 weekly 2-hour sessions<br>- diabetes and its complications<br>- the role of diet, exercise, and medications<br>- the importance of self-monitoring of blood glucose<br>- cultural beliefs<br>- encouragement to attend follow-up visits<br>Staged diabetes management | Among Project Dulce Participants:<br>- decrease in diastolic blood pressure ($P < .009$)<br>- decrease in $Hgb_{A1c}$ of 3.7% ($P < .001$)<br>- decrease in total cholesterol ($P < .001$) and LDL cholesterol ($P < .001$)<br>- decrease in triglycerides ($P < .001$)<br>- increased knowledge and treatment satisfaction<br>No significant changes in control group | No Latino-specific results; 72% of project participants were Latino<br>Only 56% of Project Dulce participants attended peer education classes; unable to distill effect of peer education<br>No randomization<br>Effect in part attributed to distribution of medications at the time of appointment |

(continued)

**Table 2.** Continued

| Quasi-experimental Trials | | | | | |
|---|---|---|---|---|---|
| **Reference** | **Sample** | **Design/Measures** | **Intervention/Theory** | **Results** | **Comments** |
| Teufel-Shone et al[29] | Yuma and Santa Cruz Counties, Arizona<br>72 patients with diabetes and 177 support family members | Pre-/post- assessment<br>Questionnaire:<br>- knowledge<br>- attitudes<br>- beliefs<br>- behaviors | 12-week program; 10 contacts:<br>- 3 home visits<br>- 5 educational sessions<br>- 2 celebratory events<br>Education:<br>- team building<br>- communication skills<br>- diet<br>- physical activity<br>- family support<br>Social Learning Theory<br>Family Social Behaviors | Decreased noncarbonated sweetened drink consumption ($P < .001$)<br>Increased joint physical activity among family members ($P = .002$)<br>Increased family support ($P = .01$)<br>No different effects in knowledge, attitudes, behaviors, and beliefs when comparing family members with and without diabetes | Inconsistent program implementation between sites (home visits vs group classes)<br>Family-based; involvement of family members in program participation<br>Results included those for family members; unknown effect on diabetes control<br>Education included information on food choices. Unclear if more in-depth nutrition information was provided<br>Unknown impact in health outcomes<br>No control group |
| *Education plus support groups* | | | | | |
| Garvin et al[24] | King County, Washington<br>348 Latino, African American, and Asian patients with diabetes | Pre-/post- survey<br>Lifestyle behaviors including diet and physical activity<br>- diabetes knowledge<br>- diabetes self-management<br>- self-efficacy<br>- social support<br>focus groups | Support groups<br>Peer education classes<br>Self-management classes<br>Care coordination<br>Socioecological model<br>Lorig Chronic Disease self-management model | Overall sample improvements in:<br>- 2 out of 8 lifestyle/health behaviors<br>- 10 out of 12 healthful diet behaviors<br>- 2 out of 6 diabetes self-management indicators<br>- 4 out of 12 self-efficacy measures | No control group<br>Only self-reported measures; social desirability bias<br>Latino sub-ethnicity and acculturation not addressed<br>Weak dietary intake assessment methodology |
| Ingram et al[25] | Farmworker community, US-Mexico border<br>70 patients with diabetes | Pre-/post- 1-y evaluation<br>Clinical data (from medical records):<br>- $Hgb_{A1c}$<br>- HDL cholesterol<br>- LDL cholesterol<br>- triglycerides<br>- blood pressure<br>Questionnaire data:<br>- perceived social support<br>- family support<br>Program participation logs | Promotoras:<br>- facilitated support groups<br>- cross-referrals<br>- basic education<br>- program appointment setup<br>- encouraged program participation<br>- facilitated access to health resources<br>On average:<br>twelve 2-h support groups per year<br>25 phone calls during 1 program year<br>Social support theory | Improvement in:<br>- $Hgb_{A1c}$ (-0.58%, $P < .01$)<br>- HDL cholesterol (+3.2 mg/dL, $P < .01$)<br>- systolic blood pressure (-5.8 mm Hg, $P < .05$)<br>Number of support group and advocacy contacts significantly correlated with improved glycemic control<br>Greater perceived social and family support | Variable extent of program participation depending on participant's availability and involvement<br>Follow-up examinations conducted at 12 ± 4 months<br>Questionnaires administered by promotoras<br>No control group<br>Data limited to medical chart availability |
| Joshu et al[26] | US-Mexico border; Laredo, Texas<br>301 patients with diabetes | Pre-/post- evaluation at 3 and 12 months<br>Clinical measures:<br>- $Hgb_{A1c}$<br>- HDL cholesterol<br>- LDL cholesterol<br>- triglycerides<br>Self-management outcomes self-reported as perceived achievement of goals | Promotora-led self management program:<br>- education classes (ten 2.5-h weekly lessons)<br>- individual follow-up<br>Lessons addressed knowledge, health beliefs, depression, glucose monitoring, medication management, physical activity, healthful eating, coping, and goal setting<br>Optional 10-session support group post-completion of self management program<br>Monthly promotora-health care provider meeting | 80.7% self-management completion rate<br>$Hgb_{A1c}$ was 0.8% lower after 3 months ($P < .001$) and 0.7% lower after 12 months ($P < .001$)<br>Lower LDL cholesterol after 3 and 12 months (6% and 17%, respectively; $P < .01$)<br>11% lower triglycerides after 12 months ($P < .05$)<br>No changes in HDL cholesterol | No Latino-specific results; patient population >95% Latino<br>Incomplete clinical data<br>No control group<br>Unknown patient selection criteria<br>Self-report of self-management outcomes |

(continued)

**Table 2.** Continued

| Quasi-experimental Trials | | | | | |
|---|---|---|---|---|---|
| **Reference** | **Sample** | **Design/Measures** | **Intervention/Theory** | **Results** | **Comments** |
| Thompson et al[27] | Oakland, California<br>142 Spanish-speaking Latino patients (Mexican American)<br>$Hgb_{A1c} > 8.0\%$, comorbid depression, or inadequate social support | Pre-/post- evaluation of<br>- $Hgb_{A1c}$<br>- blood pressure<br>- body weight<br>- LDL cholesterol | Usual care (medical visits and referrals to dietitian or health educator)<br>Peer supporters/community health workers; weekly for the first 6 months, monthly thereafter<br>- phone counseling<br>- support groups<br>- walking club<br>- diabetes classes<br>-psychoeducational group for depression<br>Chronic Care Model patient centered counseling; Transtheoretical Model | Significant reductions in $Hgb_{A1c}$ after 6 months (-0.36%) and 12 months (-0.48%)<br>$Hgb_{A1c}$ reduction at 1 y attributed to reduction of 0.78% among women at 12 months (vs +0.11% in men)<br>no effect on blood pressure, BMI, or LDL cholesterol | Report of subset of participants<br>Enrolled for at least 1 year with baseline and follow up data available and at least 6 contacts with community health workers<br>No control group<br>Potential selection bias based on willingness to participate |

Abbreviations: BMI, body mass index; $Hgb_{A1c}$, hemoglobin A1c; HDL, high density lipoprotein; LDL, low density protein.

diabetes education program delivered by a certified diabetes educator (CDE).[22] Participants were randomized to additional support by a CHW. Regarding nutrition education, the CHW only reinforced information provided by the CDE. The program completion rate was higher among participants assigned to the CHW group vs controls. Program completion was associated with improved knowledge and glycosylated hemoglobin ($Hgb_{A1c}$) levels, and changes in self-care behaviors regardless of group assignment. In a recent trial, Lujan et al recruited 150 Mexican American patients with type 2 diabetes to evaluate a promotora-delivered intervention.[23] Participants were randomized to usual care or a 6-month intervention consisting of eight 2-hour group classes and follow-up telephone calls following American Diabetes Association curriculum guidelines. The nutrition component of the intervention included only a discussion of the food guide pyramid and reading food labels. At 6 months the mean improvements in diabetes knowledge and $Hgb_{A1c}$ were significantly greater for the intervention group. Regardless of group assignment, participants' belief about their ability to manage diabetes did not change.

These two studies indicate that CHWs are capable of promoting compliance with medical appointments as well as improving knowledge and metabolic outcomes among Latinos with diabetes. The CHWs played different roles in both studies. Corkery et al worked with bilingual/bicultural Puerto Rican CHWs living in the target community and who had previously volunteered in a diabetes clinic.[22] Community health workers attended clinic sessions with their assigned clients. By contrast, in the study by Lujan et al,[23] the CHWs were bilingual clinic employees who received 60 hours of training in diabetes self-management. They delivered eight 2-hour participative classes, and had frequent follow-up contact telephone contact with their clients. This may explain, at least in part, the differences in results between the studies.

**Quasi-experimental studies.** Seven studies in which CHWs provided education for Latinos with diabetes or their families including a nutrition component had quasi-experimental designs (ie, pre/post measurements). Of the 7 studies, 4 provided support groups in addition to nutrition education.[24-27]

*Project Dulce* combined nurse case management and a group-based peer education program which covered diabetes and its complications; the role of diet, exercise, and medications; the importance of glucose self-monitoring; and discussions about experiences and beliefs about diabetes.[28] The program enrolled 153 patients with diabetes (72% Latino), who completed 12 months of visits with a nurse case manager. Only 56% of participants attended additional peer education classes. A control group included patients not enrolled in *Project Dulce* (n = 76, 69% Latino). *Project Dulce* participation resulted in decreased diastolic blood pressure, $Hgb_{A1c}$, total cholesterol, low density lipoprotein (LDL) cholesterol, and triglycerides, all of which

**Table 3.** Impact of Peer Counseling on Breastfeeding Outcomes Among Latinas

| Reference | Sample | Design/Measures | Intervention/Theory | Results | Comments |
|---|---|---|---|---|---|
| Anderson et al[33] | 135 predominantly Latina women (72%) recruited in Hartford, Connecticut | Experimental<br>Women recruited during second trimester of pregnancy from hospital certified as "baby friendly"<br>Highly trained bilingual peer counselors delivered intervention<br>Outcomes: exclusive breastfeeding duration | Exclusive breastfeeding peer counseling support offered 3 times prenatally at home, daily perinatally in hospital, and 9 times postpartum at home. In addition, phone calls as needed | 27% of Women in intervention group were exclusively breastfeeding at 3 months post-partum (vs 2.7% in the control group) | Efficacy trial<br>Impact of peer counseling on exclusive breastfeeding modified by ethnicity/race. Non-Puerto Rican Latinas and non-Hispanic Blacks benefited more from intervention than Puerto Rican women (Anderson et al[34]) |
| Chapman et al[35] | 165 predominantly Latina women (80%) recruited in Hartford, Connecticut | Experimental<br>Women recruited during second pregnancy trimester from hospital certified as 'Baby Friendly'<br>Highly trained bilingual peer counselors delivered intervention<br>Outcomes: breastfeeding initiation and duration | Evaluation of existing peer counseling program<br>Breastfeeding peer counseling support offered at least once prenatally at home, daily perinatally in hospital, and 3 times postpartum at home. In addition, phone calls as needed | 90.1% Initiated breastfeeding in intervention group (vs 77.3% in control group)<br>64.3% Breastfeeding at 1 month in intervention group (vs 50.7 % in control group)<br>44.4% Breastfeeding at 3 months in intervention group (vs 29.2 % in control group) | Effectiveness trial<br>Differences waned by 6 months postpartum<br>Impact of peer counseling on breastfeeding modified by parity, prenatal breastfeeding intentions, and early formula supplementation (Chapman et al[113]) |
| Gill et al[32] | 200 Mexican-American women recruited prenatally in the southwest United States | Quasi-experimental<br>Women recruited during second trimester of pregnancy<br>Outcomes: breastfeeding initiation and duration | 5 Phone calls during the first 6 weeks postpartum. Monthly calls during months 3-6 postpartum<br>At least 1 home visit<br>Counseling by 2 lactation consultants and 3 certified lactation educator (2 of whom were bilingual)<br>Control group received the standard breastfeeding education that could have included a breastfeeding class through a WIC clinic | Women in the intervention group were more likely to initiate breastfeeding (82.3% vs 67.1%) and to continue breastfeeding at 6 months (43% vs 21%). | No random assignment to study group<br>Few specifics on lactation educators background and extent of counseling involvement<br>Counselors involved collecting outcome data |

**Table 4.** Impact of EFNEP Education Among Latinas

| Reference | Sample | Design/Measures | Intervention/Theory | Results | Comments |
|---|---|---|---|---|---|
| Block Joy et al[45] | California (EFNEP served 13 430 families in 17 counties)<br>Multiethnic sample, with the majority (62%) being Latino (9% were black, 15% were white, 12% were Asian, 1% were Native American)<br>Only those exhibiting optimal nutrition behaviors were included in the final analysis, thus it is unclear the final composition of race/ethnicity | Cost–benefit analyses that used pre/post test survey to determine the % of individuals meeting optimal behavior score<br>included in the cost–benefit analyses were only those who exhibited optimal nutrition change behavior for that specific disease*<br>Outcomes (prevention against):<br>- colorectal cancer (n = 150)<br>- foodborne illness (n = 2011)<br>- heart disease (n = 150)<br>- obesity (n = 122)<br>- osteoporosis (n = 2769)<br>- stroke/hypertension (n = 42)<br>- type 2 diabetes (n = 87) | cost–benefit analysis replicated from Virginia<br>determined benefits and costs using 3 assumptions<br>diet and chronic disease link<br>estimation of diet-related risk<br>behavior changes lasting for 5 years | Participants achieving optimal nutrition behavior<br>- colorectal cancer (7.65%)<br>- foodborne illness (27.95%)<br>- heart disease (7.65%)<br>- obesity (6.77%)<br>- osteoporosis (20.12%)<br>- stroke/hypertension (2.57%)<br>- type 2 diabetes (5.21%)<br>Overall benefit–cost ratio $14.67 to 1.00<br>Sensitivity analyses ($)<br>- stroke (8.34 to 1) and osteoporosis (5.17 to 1)<br>- Long-term benefits: 7.33 to 1 to 3.67 to 1 | Strength: study replicated techniques and methodology used in Virginia.<br>Limitation: Although the initial sample was predominately Latino, it is unknown whether the sample used for the analyses was also predominately Latino, as only those participants exhibiting optimal nutrition behaviors were included in the final analyses |
| Dollahite et al[40] | New York state<br>15 846 graduates and 300 participants who did not complete the program | pre-/post test comparison group design<br>behavioral checklist; ie, sociodemographic, program data, 10-item checklist of questions including 1 which assesses food insecurity | EFNEP nutrition education taught in different ways: individually (35%), in groups (50%), individual and group (15%), and mailed lessons (2-3%).<br>compared those who graduated completed on or about 6 lessons and those who did not graduate did not complete 6 lessons | food insecurity scores decreased more for graduates<br>significant improvements in food insecurity scores shown among: white individuals, Latinos and black individuals (vs Asians), small town residents, and younger participants<br>individual lessons associated with greater food security | Limitations:<br>Only 1 question was used to assess food insecurity (how often do you run out of food before the end of the month?)<br>EFNEP was taught in different ways; there may be different levels of impact depending on teaching method |
| Townsend et al[39] | 10 counties in California<br>229 groups, 5508 youth aged 9-11 y enrolled in EFNEP (162 intervention groups and 67 control groups)<br>multiethnic sample; Latinos were the largest ethnic category (43%), followed by non-Latino white (13%), non-Latino black (18.8), Asian (12%), Native American (3.0), and other (10.3%) | youth groups were randomized to receive nutrition education or delayed nutrition education (control group)<br>pre/post test survey administered by EFNEP staff<br>nutrition, food safety knowledge, and food preparation were assessed via "Kid Kartoons," a booklet for youth to self-report their behaviors; designed for this intervention and validated in this study<br>evaluation measured 4 impact indicators: food variety, nutrition knowledge, food selection, food preparation and safety<br>EFNEP field staff were trained in protocol for training leaders in the intervention and administration of pre/post survey<br>leaders were also surveyed retrospectively to determine how much of the intervention was given and how it was delivered†<br>unit of analysis based on groups | adapted nutrition education from the national EFNEP publication to make it specific for 9- to 11-year-olds<br>focused on food safety and increasing awareness of fruits and vegetables for children who prepare own food at times<br>used different strategies including food puzzles and games, and food preparation<br>leaders trained by EFNEP staff to deliver intervention†<br>intervention included seven 1-hour lessons delivered in 7 wks by group leaders (mostly school teachers), and 17 activities | intervention group showed significantly more improvement for nutrition knowledge, food preparation skills, and food safety practices<br>race/ethnic specific outcomes:<br>- non-Latino whites scored highest on posttest for total scores<br>- Latinos in the intervention groups had more significant improvements compared to controls for nutrition knowledge, food preparation skills, and food safety practices | Limitations:<br>-Evaluation instrument had a correlation coefficient of 0.62, indicating it was only adequately reliable<br>-Control groups that were given some or all of the education lessons were removed from analyses<br>-Not all leaders were surveyed; unidentified control individuals may have been introduced to the intervention before the posttest survey<br>-Leaders were asked to recall the number of lessons they had given rather than recording the lessons as they were given introducing potential recall bias |

Abbreviation: EFNEP, Expanded Food and Nutrition Education Program.

*Measured as those EFNEP graduates who achieved the greatest benefit (a score of 4 or more) on all dietary practices criteria because they could be attributed to the nutrition education.

†Leaders consisted of classroom teachers, afternoon program staff, summer camp staff, community agency personnel, and teenagers.

**Table 5.** Impact of Non-EFNEP Peer Nutrition Education Among Latinos

| Reference | Sample | Design/Measures | Intervention/Theory | Results | Comments |
|---|---|---|---|---|---|
| Balcazar et al[53] | 7 sites across the United States: Illinois, Texas (n = 2), California (n = 2), New Mexico, Rhode Island<br>n = 223 families (320 individuals) served by 33 promotores | Pre-/posttest<br>knowledge<br>lifestyle behaviors<br>screening referrals | *Salud para su Corazón*<br>6-month intervention at community-based organizations<br>Seven 2-hour group sessions delivered by *Promotores* within a 2- to 3-mo period<br>Group sessions several times a week, once a week, or every other week<br>Educational materials:<br>workbooks, fotonovela<br>stories, easy to read booklets, and videos<br>Home visits and follow-up contacts to reinforce learning<br>Participatory/Social Action Research | Improvement in heart-healthy behaviors<br>Improvement in physical activity, and weight reduction and control<br>74% referred to blood pressure and 81% for cholesterol screenings | No control group<br>Acculturation not addressed<br>No in-depth dietary intake assessment<br>all measures were self-reported |
| Elder et al[50] | 2 San Diego County areas<br>n = 357<br>Spanish speaking Latinas aged 18-65 | 14-week tailored nutrition communication intervention<br>Randomization to 1 of 3 groups:<br>(1) personalized counseling via promotoras, plus tailored print materials (*Promotoras*); (2) tailored print materials delivered only by mail (tailored); (3) off-the-shelf materials also delivered by mail (control)<br>assessments at baseline, 12 weeks, 6 mo, and 12 mo postintervention | Intervention:<br>-weekly home visits or telephone contacts over 14 weeks<br>-12 tailored newsletters with homework assignments, mailed weekly<br>Control group:<br>-off-the-shelf materials, weekly homework assignments<br>Goal setting<br>Support/encouragement theories | *Promotora* group had significantly improved dietary intakes at 12 wks, including energy and total carbohydrates<br>- Group differences waned by 12 mo postintervention | Acculturation data collected but not presented<br>Changes in economic situation, or social networks not documented at 12 mo postintervention |
| Staten et al[51] | Yuma and Santa Cruz Counties, Arizona<br>n = 216<br>Female participants | Pre- and postcurriculum questionnaires<br>Self-reported measures of diet and physical activity | *Pasos Adelante*<br>12-wk program facilitated by community health workers<br>Group sessions in community settings scheduled for 2-hour periods (range: 90-150 minutes)<br>11 *promotores* (10 women, 1 man) led the sessions working in pairs<br>Promotores actively involved for 7 wks establishing walking clubs<br>Social support theory | Self-reported improvements in physical activity and diet:<br>- Increased walking and moderate vigorous activity<br>- Increased fruit and vegetable consumption<br>- Decreased soft drinks consumption<br>- Results varied by county | No control group<br>No in-depth dietary intake assessments<br>All self-reported measures |
| Taylor et al[52] | 10 southern Colorado counties<br>n = 337 (intervention)<br>n = 52 (control)<br>Female participants | -Pre-/posttests after each educational session and at 6 mo postintervention | *La Cocina Saludable*<br>36 Latina grandmothers as peer nutrition *abuela* educators<br>5 nutrition education units:<br>unit 1: Make it Healthy<br>unit 2: Make it Fun<br>unit 3: Make a Change<br>unit 4: Make it Safe<br>unit 5: Make a Plan<br>Resource Guide<br>Each unit taught in 2 group sessions, at least 1 hr long each session<br>Transtheoretical Stages of Change Model | Significant improvements in self-reported knowledge/skills<br>Benefit retention at 6 months postintervention | Scale reliability assessed<br>No randomization<br>Limited number of follow-ups<br>Acculturation not addressed<br>No in-depth measures of changes in dietary behaviors before and after intervention<br>All self-reported measures<br>-6-month follow-up questionnaire return rate=24% |

were significantly lower relative to the control group, and an increase in diabetes knowledge. The main limitation of this study was that the effect of peer counseling independent of nurse case management was not assessed.

*La Diabetes y La Unión Familiar* was a 12-week education intervention designed to enhance patients' family social support and increase primary prevention behaviors among family members.[29] Seventy-two patients with diabetes and 177 family members participated in the program, which reinforced collective esteem and efficacy as well as family communication. The nutrition education component focused on food choices and physical activity. Participation decreased noncarbonated sweetened drink intake, increased joint participation of family members in physical activity, and increased reported support for each other. No consistent change in fruit, vegetable, soft drink, or low- and nonfat milk intake was reported. This project focused uniquely on building family-based social support. However, it is limited by inconsistent program implementation between study sites (home visits vs group instruction), combination of results from patients and family members, and lack of assessment of health outcomes.

The *Community Diabetes Education* (CoDE) program recruited 162 patients, predominantly of Mexican origin (78%), who received diabetes education from a CHW during 3 initial visits and quarterly assessments over 12 months.[30] Education topics included glucose control and monitoring, hypoglycemia, sick day care, nutrition, diabetes complications, foot care, physical activity, smoking cessation, alcohol use, and goal setting. For the 55 patients with available data, $Hgb_{A1c}$ significantly decreased after 12 months. Body mass index (BMI) and blood pressure did not change with intervention. Unlike other interventions, there was a one-on-one CHW-patient interaction, which allowed for providing individual instruction and personalized meal planning. However, this study was limited by the lack of separate analysis for Latino participants.

Joshu et al conducted a *promotora*-led intervention at a Texas health center on the US-Mexico border which serves a predominately Latino population (95%).[26] The intervention consisted of 10 weekly 2.5-hour self-management education classes and individual follow-up. Additional support groups were available after program completion. Of the 301 participants enrolled, 80.7% completed the self-management intervention, and 24.6% also attended support groups. Relative to baseline values, $Hgb_{A1c}$, LDL cholesterol, and triglycerides were lower after 12 months. Participants reported achieving the self-management goals set during the program. This study was limited by lack of a clearly described nutrition education component of the training curriculum, lack of evaluation of additional support group participation on outcomes, and lack of clinical data for a high proportion of program participants.

Thompson et al evaluated a CHW-led program that included telephone-based support and classes.[27] Community health workers emphasized meal planning, exercise, blood glucose self-monitoring, and adequate medication use. Community health workers also facilitated support groups, led a walking club, and taught diabetes classes. To be included, participants had to be Latino, speak Spanish, and have $Hgb_{A1c} > 8.0\%$, comorbid depression, or inadequate social support. Overall, $Hgb_{A1c}$ decreased significantly after 6 and 12 months of program participation ($n = 142$). However, only women actually had a decrease in $Hgb_{A1c}$ after 12 months, whereas $Hgb_{A1c}$ slightly increased in men. There was no significant effect on blood pressure, BMI, or LDL cholesterol. These results could be biased, as only the subset of participants who received at least 6 CHW contacts and who had available data at 1 year were included in the analysis.

The *Campesinos Diabetes Management Program* was conducted in a farm worker community on the US-Mexico border.[25] *Promotoras* provided support, advocacy, and education for diabetes self-management (diabetes, nutrition, physical activity promotion, goal setting) through support groups and telephone and in-person contacts. The analysis included participants with available baseline and 12-month ($\pm$ 4 months) $Hgb_{A1c}$ data ($N = 70$) extracted from medical records. Participation resulted in a decrease in $Hgb_{A1c}$ and systolic blood pressure, and an increase in high density lipoprotein (HDL) cholesterol. There were no significant effects on LDL cholesterol, triglycerides, or diastolic blood pressure. $Hgb_{A1c}$ improvement was correlated with the number of support group and advocacy contacts. Study limitations included the fact that data were not available for all program participants, lack of standardization of *promotora*-client contact amount, and the approach of using *promotoras* for data collection.

The Racial and Ethnic Approaches to Community Health (REACH) 2010 project recruited 348 patients with diabetes from a multiethnic population (37% Latinos).[24] Participants and their family and friends engaged in support group discussions on healthful diet, physical activity, and coping with stressors including discrimination. Peer educators taught classes on culturally appropriate healthful eating, weight management, physical activity, and diabetes. Trained facilitators offered an additional self-management class. Latinos reported significant improvements in their ability to maintain a healthful diet, eat more vegetables and low-fat food, and eat less salt and sugar, and showed increased knowledge about diabetes care practices. Latinos showed significant improvements in their self-confidence to exercise for 30 minutes/day and in diabetes management and showed increased ability to control their weight.

As with the randomized trials, the CHWs had diverse backgrounds and played different roles across studies. *Project Dulce*'s CHWs were individuals with diabetes themselves and leadership skills.[28] They received 2 training programs, including the 24-hour-long project training curriculum, and they delivered education in a group setting. *La Diabetes y la Unión Familiar* hired *promotoras* who worked at a community health clinic but did not have diabetes education experience and *promotoras* who worked in a community-based diabetes prevention program.[29] All *promotoras* underwent a 1-day training

session and delivered their services at home as well as in diverse community settings. The *Campesinos Diabetes Management Program* had CHWs whose main role was to facilitate social support groups.[25] In the study by Joshu et al,[26] CHWs delivered group education, had weekly follow-up contact with their clients, and facilitated support groups. Community health workers met monthly with physicians to discuss patients' diabetes self-management challenges. The CHWs recruited by Thompson et al were female patients from their target clinic with community leadership skills, who either had diabetes themselves or had a family member with diabetes.[27] Community health workers received 30 hours of training in diabetes management and the transtheoretical stages of change model. Their services included one-on-one counseling (mostly telephone-based), as well as group education. The CoDE Program employed a CHW to help patients with diabetes self-management under the direct supervision of a physician through 7-hour patient contacts over a 12 month period.[30] The CHW had a high school equivalence degree and was certified as a *promotora* by the state of Texas.

**Summary.** Overall, participation in CHW-delivered programs for diabetes self-management resulted in improved glycemic control,[22,23,25-28,30] lipid profile,[25,26,28] and blood pressure.[25,28] Improvement in diabetes knowledge,[23,28] self-management behaviors,[24,26,29] and social or family support[25,29] were also reported. Six out of the 9 studies based their intervention on at least 1 behavioral change theory. However, the specific operationalization of theory constructs was generally not reported.

Studies reviewed in this section had a wide variety of designs and methods of nutrition education delivery by CHWs. Several programs hired women with diabetes or with a relative with diabetes as CHWs. When reported, it appears that potential CHWs were selected based on their leadership skills and empathy toward their own community. Community health workers' previous paraprofessional experience and diabetes management training length and content also varied widely across studies. Only one study actually reported hiring a CHW certified as such by the state where the study took place.[30] It is important to note that the only study that reported offering to the CHW both in-depth diabetes management training as well as behavioral change theory training is the one reporting a strong dose response relationship between the number of contacts by the CHW and the strength of the improvement in $Hgb_{A1c}$.[27] There is a need for further research to better understand the ideal background CHW characteristics and leadership attributes, intensity of contact needed between CHW and patient to attain the desired outcomes, and study training protocols.

Likewise, the optimal role for CHWs has not been carefully studied. This is an important question, since the studies reviewed in this section assigned diverse roles to their CHWs ranging from social support group moderators to assisting with diabetes self-management care under the direct supervision of a physician. Once efficacy studies are conducted, cost-effectiveness studies can then be designed to assess how to formally integrate CHW diabetes education programs that include sound nutrition education as part of the formal health care system. Additionally, carefully controlled randomized trials are needed to assess the independent effect of CHW-delivered nutrition education on glycemic control and diabetes self-management. Finally, since most of the studies reviewed included Latinos of Mexican origin, further research with other Latino subgroups is needed.

## Breastfeeding Promotion

International evidence suggests that peer counselors can have a positive impact on breastfeeding behaviors in very diverse sociocultural settings.[15] Peer counselors have played a role in breastfeeding promotion in the United States since the 1980s.[31] However, until recently, few experimental or quasi-experimental studies were available to understand the impact of peer counseling on breastfeeding outcomes among Latinas.

Gill et al conducted a study in the southwestern United States to assess the impact of lactation support on breastfeeding outcomes among Mexican-American women.[32] Women were recruited from a health department clinic during the second trimester of pregnancy. The intervention group (n = 100) received up to 2 prenatal breastfeeding counseling sessions from a lactation consultant. Women were called 5 times during the first 6 weeks postpartum and monthly from 3-6 months postpartum. Calls were made by either a lactation consultant or a certified lactation educator. Two of the three study lactation educators were bilingual. Upon request, the study lactation consultants and/or educators visited the women in their homes. All women in the intervention group received at least 1 home visit. The control group received the standard breastfeeding education that could have included a breastfeeding class through a Women, Infants, and Children (WIC) clinic. Women in the intervention group were more likely to initiate breastfeeding and to still be breastfeeding at 6 months. Limitations of this study included the lack of random assignment to study group, the lack of specifics on the background of the lactation educators, and the variable extent of their involvement.

Anderson et al randomly assigned 162 women living in Connecticut to either a breastfeeding peer counseling group or a control group.[33] Women were recruited in the prenatal care clinic of an inner-city hospital certified as "baby friendly" and were enrolled if they were planning to breastfeed. Women who delivered a preterm infant were excluded from the study. Women in the intervention group were visited in their homes by their peer counselor up to 3 times prenatally, daily during the postpartum hospital stay, and up to 9 times postnatally. The great majority of study participants were Latinas (72%). Exclusive breastfeeding from birth until 3 months postpartum was significantly higher in the intervention than in the control group. Con-

sistent with this finding, women in the intervention group were significantly more likely to remain amenorrheic and their infants to have a lower incidence of diarrhea at 3 months. A subsequent differential response analysis showed that non-Puerto Rican Latinas and non-Hispanic black women benefited much more from the intervention than their Puerto Rican counterparts.[34]

Chapman et al used an experimental design to assess the effectiveness of "Breastfeeding: Heritage and Pride," a breastfeeding peer counseling program in Hartford, Connecticut, targeting low-income women.[35] Participants were recruited from the prenatal care clinic of a certified baby-friendly inner-city hospital serving a predominantly Latina clientele and were included if they were planning to breastfeed and if they delivered a healthy term infant. Women were randomly assigned to receive services from "Breastfeeding: Heritage and Pride" or to a control group. The peer counseling intervention consisted of 1 prenatal home visit, 3 postpartum home visits, and telephone contact as needed. The proportion of women initiating breastfeeding was significantly higher in the intervention than in the control group. This difference was sustained at 1 and 3 months but was no longer statistically significant by 6 months. As in the study by Anderson et al,[33] the authors identified several effect modifiers. Women who benefited the most from this intervention were those who were multiparous, those who were uncertain about their breastfeeding intentions prenatally, as well as those who were mix-feeding at 1 day postpartum.

A comparison of the last 2 studies shows that breastfeeding peer counseling is a highly efficacious intervention under ideal research controlled conditions[34] and has an impact under real program conditions,[35] although as expected in this instance, the impact is of lower magnitude. These studies also illustrate the importance of examining effect modifiers, since participants' characteristics clearly influenced the degree of benefit received from the intervention.

## Peer Nutrition Education

**The Expanded Food and Nutrition Education Program (EFNEP).** The Expanded Food and Nutrition Education Program (EFNEP) was designed as a program relying on nutrition education paraprofessionals to target the dietary habits of low-income households with children. Nutrition aides initially taught food and nutrition principles to families in their homes. By 1969 there were 5000 paraprofessionals reaching out to 200 000 families nationwide. Nutrition aides were hired from the target communities.[13] Contento's review in 1995 highlighted several early studies showing that EFNEP participation is associated with improved dietary habits.[13]

Evaluating the effectiveness of EFNEP at improving nutrition-related behaviors has been the basis of several national reports, statewide and local research studies, and cost-benefit analyses. National evaluations of EFNEP have been conducted since 1999 to assess and monitor the impact of this program on the dietary intake, nutrition knowledge, and food behaviors of low-income participants in the United States. Consistent with most national findings, randomized controlled trials and quasi-experimental studies examining the impact of EFNEP on nutrition-related outcomes among local populations have demonstrated improved dietary intake,[36] nutrition knowledge,[37-39] food practices,[37-39] and food insecurity,[40,41] with some improvements being observed a year after graduation from the program.[37,38]

Cost–benefit studies have also emerged from selected states to determine the indirect and direct benefits of EFNEP on health care costs and work productivity.[41-45] Findings from these studies support EFNEP as a program that prevents diet-related illnesses and diseases, reporting benefit–cost ratios anywhere from approximately 3:1[44] to 17:1.[43] In fact, a few research studies have documented economic benefits of EFNEP, including program-related improvements in employment[37,38] and education.[38]

Only a few studies have examined the possible effect modification of race/ethnicity on EFNEP's nutrition-related outcomes. This issue is relevant for this review, as 36% of EFNEP participants are Latino. Townsend et al conducted the first randomized control study evaluating the impact of the EFNEP on nutrition-related behaviors among low-income youth.[39] This study, conducted in 10 counties in California, included a multiethnic sample of 5111 children (43% Latino) from 229 youth groups. Children randomized to the intervention group received 7 EFNEP education lessons (within 6-8 weeks) delivered by their respective group leaders (mostly teachers). Those in the control group did not receive these lessons until after 8 weeks. Overall, children in the intervention group had improved outcomes in their nutrition knowledge, food preparation and safety skills, selection of food, and eating varieties of food. Townsend et al found that Latino youth who received 7 nutrition education lessons had significantly greater improvements in their nutrition knowledge and food preparation skills/food safety practices compared to those who did not receive the education. However, among Latino youth, no significant improvements between intervention and control groups were found for 2 other indicators, reflecting dietary variety and selection of nutritious food. Further studies are needed to determine whether ethnicity/race modifies the effect of EFNEP.

Results from a multiethnic study conducted by Dollahite et al reported specific benefits of the EFNEP program on food insecurity among Latino adults.[40] Participation in the New York State EFNEP during 1999-2001 was found to ameliorate food insecurity among Latinos, measured by the single question, "How often do you run out of food before the end of the month?" After controlling for socioeconomic and demographic characteristics, Latinos' food insecurity scores improved from entry to exit in EFNEP compared to Asians. Non-Latino white and non-Latino black individuals also experienced improvements in food insecurity com-

pared to Asians, suggesting that EFNEP nutrition education provides most racial/ethnic groups with tools that enable them to ameliorate their food insecurity level.

A cost–benefit analysis was conducted by Block Joy et al among a subsample of participants enrolled in EFNEP in California in 1998.[45] Over 60% of families participating in EFNEP in California at that time were Latino. Using stringent criteria replicated from other studies,[43] the authors first determined that 2%-28% of EFNEP graduates practiced "optimal nutrition behaviors" to prevent/protect against specific illnesses/chronic diseases (ie, colorectal cancer, foodborne illness, heart disease, obesity, osteoporosis, stroke/hypertension, type 2 diabetes). Cost–benefit analyses were conducted to evaluate the impact of the EFNEP program on reducing medical costs. Overall, EFNEP resulted in a savings of $14.67 in medical care costs for every $1.00 spent. The authors also determined that EFNEP nutrition education reduced long-term medical costs. For EFNEP graduates who maintained "optimal nutrition behavior" over 5 years, California saved at least $3.67 dollars per person in future medical treatment costs.

These studies document several benefits of EFNEP nutrition education for Latinos. Results are consistent with other EFNEP studies including non-Latino participants. Thus, EFNEP benefits may not be race/ethnic specific but rather are experienced by all participants.

**Food Stamp Nutrition Education (FSNE).** The USDA Food Stamp Program (FSP) is the largest food assistance program in the world. In FY 2006 it served 27 million people at a cost of $30 billion. The FSP transfers cash to households in an electronic debit card that can be used to purchase food at supermarkets, food shops, and even some farmers' markets. The FSP has very few restrictions regarding the types of food that can be bought, thus nutrition education may be essential for improving food shopping decisions of program recipients. The Food Stamp Nutrition Education Program (FSNE) officially started in 1981 through an act of Congress, which sought to provide nutrition education to food stamp recipients using approaches developed by EFNEP and other programs and following a $1:$1 federal:state match funding mechanism. By FY1992 only 7 states were participating, and those states received a total of $661,000 in federal funds. Since then the program has grown exponentially, and it now includes 52 states and territories that receive about $275 million in federal funds. Food Stamp Nutrition Education program content varies from state to state and includes one-on-one and small group education as well as food and nutrition social marketing campaigns.[14] Addressing the effectiveness of this program is very relevant to this review, as FSNE targets low-income Latinos in many states and often involves the use of nutrition education paraprofessionals. Even though Latino-specific FSNE programs exist[46] and conceptual impact evaluation efforts are underway,[47-49] no published studies met the authors' inclusion criteria.

**Demonstration programs.** The authors identified 4 additional nutrition education demonstration programs involving community health workers, only one of which was a randomized controlled trial. Elder et al conducted a randomized controlled trial among 357 Spanish-speaking Latinas to examine the 1-year impact of behavior change approaches to reduce dietary fat and to increase fiber intakes.[50] During the 14-week program, participants were randomly assigned to 1 of 3 groups: (1) *promotoras*-led intervention group, involving weekly home visits or telephone contacts plus nutrition-tailored newsletters with homework assignments mailed weekly to participants' homes; (2) tailored intervention group, involving weekly mailing of the same newsletters used with the *promotora* group; and (3) control group, involving mailing of 12 off-the-shelf materials covering the same modules and content as the newsletters. Intervention impact was assessed at baseline, 12 weeks, 6 months, and 12 months postintervention. Outcomes were based on 24-hour dietary recalls and anthropometric measures. At 12 weeks, participants in the *promotora*-led group had significantly lower intakes of total and saturated fat, glucose, and fructose than those in the tailored group and significantly lower intakes of energy and total carbohydrates than those in the control group. By 12 months, between-group dietary intake differences were no longer detected, suggesting that interpersonal contact with the *promotoras* is important to achieve long-term success.

*Pasos Adelante* (Steps Forward), a 12-week program facilitated by CHWs, is a revised curriculum of the National Heart, Lung, and Blood Institute cardiovascular disease prevention program, *Su Corazón, Su Vida* (Your Heart, Your Life). The impact of this intervention was assessed in Arizona using pre- and postcurriculum questionnaires of self-reported measures of physical activity and dietary patterns in 216 participants who completed the program.[51] Program participation was associated with increased physical activity, lower soft drink consumption, and increased consumption of fruits and vegetables. However, the benefit was stronger in one of the 2 counties included in the study.

*La Cocina Saludable* (The Healthy Kitchen) was implemented in 10 southern Colorado counties to improve nutrition-related knowledge, skills, and behaviors among low-income Latina mothers of preschool children based on the transtheoretical model and assessing scale reliability.[52] Latina grandmothers and grandmother figures (*Abuelas*) were selected as peer educators to deliver 5 nutrition education sessions. Peer educators participated in a 2-day training program. Program evaluation was based on 337 participants. Tests were administered before and after each class to assess immediate changes in knowledge, skills, and self-reported behaviors, and results were compared to a control group of 52 participants. A survey was mailed at 6 months postintervention to examine benefit retention. Return rate at 6 months was only 24%, and these results were not compared to the control group. Significant improvements were documented for self-reported nutrition, diet, and food safety knowledge/skills, and these improvements were re-

tained at 6 months. Study limitations included very low follow-up survey response rate, lack of comparison of follow-up intervention group data with controls, all the measures were self-reported, and no in-depth dietary assessment methods were used.

Balcazar et al evaluated the effectiveness of the *Salud para Su Corazón* (Health for your Heart) National Council of La Raza *Promotora Outreach Program*.[53,54] The goal of the program was to improve heart-healthy behaviors among 223 Latino families participating at 7 sites across the United States. The intervention consisted of 7 two-hour lessons that took place during the first half of a 6-month intervention plus home visits or telephone contacts to reinforce the educational activities learned in the program. Participating families completed a 35-item survey on heart-healthy behaviors before and after the sessions. The program was associated with improved overall heart-healthy score, which included physical activity, weight, and cholesterol, fat, and sodium intake. The greatest improvement was observed on practices related to dietary cholesterol and fat. This study was limited by the lack of a control group, the fact that all the measures were self-reported, and lack of in-depth measures of dietary intake.

**Summary.** Overall, these nutrition education demonstration studies suggest that peer education has the potential to change dietary behaviors among Latinos. However, several limitations to the studies deserve consideration. Most studies failed to address important factors in their analysis, such as acculturation, which can play an important role in the effect of nutrition education interventions.[46] Moreover, the majority of the data in these studies was self-reported, thus the possibility of social desirability bias cannot be excluded.

Consistent with the previous sections of this review, the characteristics of CHWs, as well as their training and roles, varied widely across studies. *Salud Para su Corazón* worked with *promotoras* already employed by the community-based organizations (CBOs) participating in the study.[53,54] The *promotoras*' training program included 50 hours of curriculum exposure, participation in a 2-day national *promotoras* conference, and monthly updates. The *promotoras* delivered their services mostly through group education in the CBOs, but they were also allowed to have contact with their clients at their homes or by telephone. *La Cocina Saludable* program was implemented by senior Latinas who were grandmothers or *abuelas*.[52] They were recruited through job advertisements, as well as health and social agency referrals. The vast majority of them were females, most of them older than 40. Only 31% had a bachelor's degree, 64% were fluent in Spanish, and over three quarters had previous teaching and community services experience. *Abuela* educators were trained with the same curricula that they were going to use with their clients. A strength of these studies is that they both documented the effectiveness of trainings at improving *promotoras*' knowledge and skills.[52-54] The study *Pasos Adelante* worked with *promotoras* employed by 2 different community agencies who received 6 hours of manual training, although several of them had received prior training on heart disease prevention.[51] Senior and junior *promotoras* worked in pairs, and they delivered group lessons to their clients and facilitated walking clubs at diverse community settings. Only 1 out of the 11 *promotoras* was male. In the trial by Elder et al, the *promotora's* role was to work with clients in their homes or via telephone around themes highlighted by the tailored newsletters and homework assignments.[50]

## CONCLUSIONS

This systematic review of experimental and quasi-experimental studies provides evidence that peer nutrition education has a positive influence on diabetes self-management and breastfeeding outcomes, as well as on general nutrition knowledge and dietary intake behaviors among Latinos in the United States. These findings are consistent with studies conducted with non-Latino white and black individuals, which suggests that it is important to formally incorporate peer nutrition educators as part of the CHW framework and to integrate them as part of public health and clinical health care management in the United States. This strategy could contribute to addressing the health disparities that seriously affect Latinos and other minority groups.

There is a need for prospective experimental and controlled quasi-experimental studies to further examine the impact of peer nutrition education among Latinos. The majority of studies reviewed based their interventions on at least 1 behavioral change theory. However, hardly any studies provided specifics on the operationalization of theory constructs. Likewise, hardly any of the interventions reviewed addressed the influence of acculturation as an effect modifier. With few exceptions, there was a consistent lack of information on nutrition knowledge, self-efficacy and behavioral scale reliability across studies. Thus, it is imperative that future studies be designed based on sound behavioral change theories that take into account the major role of acculturation in shaping lifestyle behaviors and health outcomes in Latino communities.[46] It is essential to report the reliability of scales to further advance the knowledge in this field. When experimental studies are not possible to conduct, strong quasi-experimental study designs are very useful. However, these studies should always aim to include a comparison group. Unfortunately this was not the case for most of the quasi-experimental studies included in this review.

A surprising finding from this review is that the authors could not identify any experimental or quasi-experimental study assessing the impact of FSNE among Latinos, even through this major program has been in place for over a decade. Many states include peer nutrition educators as part for their FSNE delivery strategies. Thus, this represents a major gap in knowledge. An outcome evaluation strategy similar to EFNEP's behavioral checklist is being proposed.[39,47-49] However, no specific recommendations have been made regarding

identification of impact of peer educators. Also, Spanish-speaking Latinos are not being targeted during initial development of the evaluation strategy. This issue is important to address, as there are FSNE programs devoted to addressing the nutrition education needs of mostly Spanish-speaking audiences.[55]

Future studies should move beyond assessing self-reported behaviors and include objective measures such as anthropometry, biomarkers, and blood pressure. They should also have enough statistical power to compare diverse Latino subgroups. Finally, there is a need to better understand how nutrition peer educators can be formally incorporated into the health care system within the Chronic Care Model CHW framework. Operational research is needed to identify the characteristics that peer educators should have, the general and specific training that they should receive, the client loads and dosage (ie, frequency and amount of contact needed between needed peer educator and client), the educational approach (eg, individual, small group, large group), and the setting (home, community sites). Studies published thus far vary widely in these parameters, and no clear patterns have emerged to make objective process recommendations. This operational research gap is worrisome as Dickin et al have shown that the characteristics of peer nutrition educators and the work context are significant determinants of nutrition education program effectiveness.[56]

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