

Secretos de la Buena Vida: processes of dietary change via a tailored nutrition communication intervention for Latinas

Barbara Baquero^{1*}, Guadalupe X. Ayala¹, Elva M. Arredondo¹,
Nadia R. Campbell², Donald J. Slymen¹, Linda Gallo³ and John P. Elder¹

Abstract

Secretos de la Buena Vida was a successful tailored nutrition communication intervention delivered to Latinas living along the US–Mexico border in California. The intervention was delivered over a 14-week period and consisted of three intervention conditions: weekly home visits with promotoras + weekly tailored mailed newsletters in the first condition, weekly tailored mailed newsletters in the second condition and targeted materials in the attention control condition. The current study examined what elements of the promotoras + tailored newsletter and tailored newsletter-only conditions were most effective for behavioral adoption and maintenance in a sample of 238 Latina women. Process evaluation measures assessed the implementation, fidelity and dose of these two intervention conditions. Results indicate that there was high fidelity to program implementation and delivery. Perceived effort, perceived support and intervention length predicted adoption of a lower fat diet at the 15-month follow-up. In the promotoras + tailored newsletter condition, married women were four times more likely to be adopters of dietary fat changes than single

women. These findings highlight the importance of process evaluation measures and help us understand the mechanism by which tailored print materials and interpersonal health communication via promotoras can facilitate health behavior change.

Introduction

Evidence shows that Latinos eat more fruits and vegetables than other minorities [1–3], yet consume a greater quantity of dietary fat [4]. In addition, the process of acculturation is associated with decreases in fruit and vegetable consumption and a change in dietary practices that are associated with consumption of more saturated fat [5]. Unhealthy diets are a major risk factor for disease incidence [6], and among Latinos, poor dietary practices have been shown to be associated with obesity [7], diabetes [8], cancer and other chronic diseases [9–13]. In turn, these diseases are disproportionately higher among Latinos compared with non-Latinos [7, 14].

Intervention strategies

Theoretical foundation

The Transtheoretical Model (TTM) [15, 16] and McGuire's Communication Persuasion Model (CPM) [17–19] have been used to inform the development and implementation of tailored communication interventions. Readiness to change measures from the Stages of Change component of TTM serve to tailor messages that are salient and appealing to the audience [15, 20]. McGuire's CPM provides

¹Graduate School of Public Health, San Diego State University, San Diego, CA 92115, USA, ²Center for Behavioral and Community Health Studies, San Diego State University Research Foundation, San Diego, CA 92123, USA and ³Joint Doctoral Program in Clinical Psychology, San Diego State University–University of California at San Diego, San Diego, CA 92115, USA

*Correspondence to: B. Baquero. E-mail:

bbaquero@projects.sdsu.edu

a matrix that informs the communication process with outputs that lead to behavior change and inputs which inform what factors to manipulate to facilitate behavior change [17, 21]. These models are used to consider characteristics of the targeted audience by providing examples and suggestions that are relevant to the individual's readiness to change. Combining these models have been shown to address not only barriers to reaching Latinos for health interventions but also for developing culturally appropriate dietary interventions for these communities [22, 23].

Dietary interventions

Dietary interventions designed for Latinos have used mailed print materials, family-based or interpersonal contact intervention strategies [24–32]. However, the results of these interventions are mixed, with inconsistent effects on adoption of dietary behaviors [33–35]. These methods by themselves may have fallen short to reach Latinos for behavioral change. Evidence shows that Latinos prefer health communication pieces that are culturally adequate, visually interesting and linguistically appropriate [35–38]. Two general approaches to enhance health communication messages include tailoring and targeting strategies [33, 39]. Published studies demonstrate that tailored nutrition education programs can effectively alter dietary intake [37, 40]. Even though there is an extensive body of evidence on the effectiveness and efficacy of tailored health communication interventions [34, 38, 39, 41], little is known about how tailored health communication interventions function to change behaviors in Latino communities [20–42]. Eakin *et al.* [40] used tailored materials and promotoras to improve chronic disease management among Latinas. The study found significant and positive effects on dietary behaviors and support for healthy lifestyle changes.

In addition to tailoring materials to reach Latinos, promotoras are effective in reaching minorities and increasing the relevance and salience of health messages [43–45]. Promotoras are female community leaders who are ethnically similar to the target population. They share verbal and non-verbal language with the community and understand the commu-

ity's health beliefs and barriers [46, 47]. Moreover, promotoras can address some of the acculturation barriers that may be playing a role in the behavioral efforts of the target audience [48, 49]. The combination of promotoras as interpersonal channels of information and tailored print materials has the potential to enhance and increase the power of dietary intervention among Latinos. However, only a few studies have reported on the processes of change of an effective promotora-based intervention, using tailored materials [41, 48]. One way to examine these processes is through the use of process evaluation methods. Recent studies have focused on process evaluation of nutrition interventions [49, 50], and several have examined what components explain the impact of promotora-based interventions in minority communities [31, 47, 51, 52]. Understanding the mechanisms by which promotoras and tailored print materials enhance behavior change would inform future health promotion interventions.

Process evaluation

The use, extent and definition of what constitutes an appropriate process evaluation has developed in the last 20 years [49, 50]. Ideally, intervention trials should assess recruitment efforts and outcomes (e.g. reach), implementation methods and barriers to implementation, degree of adherence, exposure to, initial and continued use of intervention components, maintenance efforts and outcomes, context or setting of the intervention, resources used by the intervention and possible contamination across conditions [47, 49, 50]. Researchers can avoid Type III error, which is failing to determine that the program worked because it was not implemented correctly, by using strategies that assess intervention fidelity [53]. More importantly, process evaluation information enables investigators to determine which intervention components were linked to the outcomes [49].

Present study

Data for this study were derived from *Secretos de la Buena Vida*, a three-arm home-based randomized

controlled trial that combined traditional and innovative methods to promote healthy dietary lifestyles among adult Latina women. The conditions included a promotora + tailored newsletter condition (P + N), a tailored newsletter-only condition (N) and an attention control condition (C) which received targeted materials [20, 23].

The present study represents a secondary data analysis to (i) describe the process evaluation findings of the *Secretos de la Buena Vida* intervention and (ii) identify and examine what components of this intervention had the most impact on behavioral adoption. These findings will increase our understanding of the active components of a tailored intervention for Latinas by examining the association of these components to the adoption of dietary behavior change.

Methods

Study design

The present study utilized demographic and process evaluation measures to examine their effect on adoption of dietary changes observed among women who participated in the P + N and N conditions at the 3-month immediate post-intervention time point and at the 15-month follow-up. These analyses excluded information about the control condition, yielding a sample size of 238.

The dose–response and implementation of this tailored nutrition communication intervention represented our process evaluation measures. Demographic, dose–response and implementation variables were examined as predictors of adoption of healthy dietary changes among the study sample at immediate post-intervention (3 months). These variables were then examined as predictors of change or maintenance of change at the 15-month follow-up. All activities and procedures were approved by the San Diego State University Institutional Review Board.

Setting

There are >3 million people living in San Diego County. Of those, 1 million are Latino (US Census

Bureau, 2000) [20]. Women targeted for this study lived, on average, ~10 miles from the US–Mexico border. Due to their proximity to the border, Latinas living in San Diego County maintain strong ties to their country of origin and are exposed to diverse social and cultural factors unique to the Latino immigrant experience [54].

Recruitment

Women were recruited via random digit dial from a pool of 2572 telephone numbers. This list contained Spanish-surnamed residential telephone accounts from the west central and ‘South Bay’ regions of San Diego County. Four hundred and sixty-six participants were recruited into the study. Baseline data were collected from 357 participants. Adult, Spanish language-dominant women between 18 and 65 years of age were included in the study. Women who were pregnant, on a special diet for medical conditions or planning to leave the study area during the intervention period, were excluded from the study. Additional details regarding recruitment have been published elsewhere [20, 23, 55].

Secretos de la Buena Vida intervention

This innovative tailored nutrition communication intervention addressed low-fat and high-fiber diet consumption. The intervention was delivered over a 14-week period. After participants were recruited and measured at baseline, they were randomly assigned to one of the three conditions: promotoras + tailored mailed newsletters (P + N), tailored mailed newsletters only (N) or an attention control condition (C). Women in the P + N condition were mailed 12 weekly tailored newsletters with a weekly homework assignment. In addition, they received 12 weekly home visits or telephone calls from an assigned promotora. Women in the N condition were mailed 12 weekly tailored newsletters and homework assignments to be completed on their own and returned in the mail to qualify for a raffle prize. Participants in both conditions also received one magnetic flower petal mailed with each of the 12 newsletters, starting with Newsletter no. 2 and ending with

Newsletter no. 11. They also received recipe cards that were delivered at the end of the intervention period.

The design of the newsletters and homework assignments were determined after a yearlong intensive formative research phase [22]. These materials were created using baseline data provided by the participant, including measures of readiness to change fat and fiber intake used to tailor the messages following a standardized protocol [42, 56]. Thus, the messages and complexity of the homework assignments were based on the participant's readiness to change. The 12 newsletters provided feedback on the participants' body mass index, their fat and fiber intake using a brief screener, healthy ways of improving the family's top 10 meals, their stage of change for fat and fiber intake, their personal relevance for making healthy lifestyle changes and barriers to healthy eating. Homework assignments gave participants the opportunity to engage in behavioral strategies such as self-monitoring, goal setting and skills development. The magnetic flower petals contained healthy lifestyle messages, a prompt for behavioral change; the eight recipe cards served as a prompt for generalization of dietary behavior changes. Materials given to participants in the attention control condition consisted of Spanish language nutrition materials targeted to Latinos that addressed topics similar to the tailored materials developed for the intervention. Most of these materials were produced by the National Heart, Lung, and Blood Institute [20, 57].

Promotoras' role in the intervention

Promotoras were an essential component of the *Secretos de la Buena Vida* intervention. Four promotoras were recruited from the targeted community. They were Spanish language dominant, empathetic, interested in helping others in their community and able to establish rapport. The promotoras were trained to encourage and guide participants in the P + N condition to complete and return the homework assignments to qualify for a raffle. Promotoras provided support and served as role models to reinforced skill acquisition associated with behavior change. Promotoras used the

participant's weekly newsletter as a guide. This served as an opportunity to further tailor the participant's newsletter.

Measurements

Process evaluation

Self-report The immediate post-intervention survey included 17 questions to evaluate receptivity to and utilization of the intervention materials. Development of these questions was informed by McGuire's CPM [17]. Thirteen questions assessed awareness, confidence, liking, attention grabbing, ease and perceived utility of the materials received, for example, 'how much did you trust the information in the newsletters?'. Response options ranged from 0 (not at all) to 4 (completely). A sum score labeled as 'impressions' was created from these questions and used as a predictor variable in the analyses. Two questions assessed level of effort in the intervention activities and level of interpersonal support received for behavior change. Both questions were assessed on a 10-point scale, with 1 = no effort/support to 10 = complete effort/support. One question measured whether the participant shared the intervention materials with anyone (yes/no), and another question assessed if the women kept the materials after the program was completed (yes/no).

Intervention monitoring Assessment of intervention length, dose received and dose delivered was conducted. Intervention length was defined as the period needed to complete intervention participation. The intervention was designed to be delivered over a 14-week period, but research staff maintained records of the actual number of weeks between delivery of the first and last newsletter. Dose received was defined as the number of homework assignments returned by the participants in both the P + N and N conditions and was tallied by research staff. Dose delivered among those in the P + N condition included the number of minutes of interpersonal contact between promotoras and participants and the number of home visits (versus telephone calls) that each participant received, both tracked by the promotoras.

Diet Three 24-hour dietary recalls were collected to obtain estimates of dietary intake. This study used the Nutritional Data System developed by the Nutrition Coordinating Center at the University of Minnesota. This technology reduces recall bias by using a multiple pass approach to recall, enter and verify food records. Visual aids were used to assist participants in food portion estimation [58]. The primary outcomes of interest for this study were adoption of dietary fat change and dietary fiber change at the 3-month immediate post-intervention time point. Dietary change scores were calculated by subtracting post-intervention mean values from baseline mean values. Second, appropriate effect sizes for total dietary fat and fiber were determined based on the calculated effect size for the main trial and a review of the effect sizes used in similar studies of dietary change [34, 45, 59, 60]. Third, cut-points were established a priori to categorize women as adopters or non-adopters. For total fat intake, participants who reduced their total fat intake by 10 daily grams or more were coded as 'adopters' and those who did not reduce their total fat intake by at least 10 daily grams were coded as 'non-adopters'. For dietary fiber, a cut-point of 2 g day⁻¹ was used to classify participants as adopters and non-adopters.

To test the predictors on long-term changes in behavioral adoption, previously stated cut-points were applied to the changes observed between the 3-month post-intervention and the 15-month follow-up. The mean change values were used to create the following three categories of adopters. Group 1 included 'maintainers' and 'late adopters'. Maintainers were those participants who maintained their 3-month adoption status at 15-month follow-up and late adopters were those participants who achieved behavioral adoption at the 15-month follow-up. Group 2 included 'relapsers', in other words participants who were categorized as adopters at immediate post-intervention but who did not meet the cut-up point at the 15-month follow-up. Group 3 included non-adopters, those participants who never achieved behavioral adoption. This latter group was used as the reference category.

Procedures

Spanish-speaking, bicultural research assistants (RAs) completed all data collection procedures. The RAs were blinded to participants' intervention condition and were not involved in any aspect of the intervention, including interacting with the promotoras. The RAs scheduled home visits from Wednesday through Saturday. After scheduling the home visit by telephone, the RAs mailed three dietary record forms for participants to record all consumed foods before the scheduled visit. All measurements were completed in Spanish and all conditions completed all measurement protocols. At the home visit, the RA collected the previous 3 days of dietary intake from the participant, completed the interviewer-administered survey and measured the participants' weight, height and waist and hip circumferences.

Data analysis

Data were inspected for completeness and normality. Statistical Package for the Social Sciences (SPSS for Windows, release 11.5, 2002, SPSS, Chicago, IL, USA) was used to perform the analyses. Means and standard deviations (SDs) were calculated for all continuous variables and frequencies were obtained for all categorical variables. Categorical demographic variables with more than two categories were dichotomized using a median split. Logistic regression analyses were performed at 3 months and polychotomous regression at 15 months to examine demographic and process-related predictors of behavioral adoption, including age, education, marital and employment status, household size, impressions of print materials, perceived effort to change and perceived support to change, retention and sharing of material, length of the intervention and number of homework assignments returned. Each regression analysis was run twice, once with both intervention groups P + N and N represented and with P + N participants only given the inclusion of additional process variables in these analyses (time and type of contact with promotora).

Results

Demographics characteristics and dietary outcomes

The sample size for the present study was 238, with retention of 84% of the sample at 3 months and 74% at 15 months. At baseline, the mean age of these participants was 39.5 (SD = 10) years old. Close to 76% of the women reported completing high school. The women were primarily married (79%) and homemakers (50%). Fifty-eight percent of the women reported a monthly household income of at least \$2000 and a median household size of four members. All the women were Spanish language dominant. The mean number of years living in the United States was 16 (SD = 10.3). Over half of the sample rated their health as fair to poor (see Table I). There were no statistically significant differences in demographic characteristics by adopter status.

At 3 months, 44% of the participants ($n = 105$) were categorized as adopters of dietary fat change and 30% ($n = 72$) were categorized as adopters of dietary fiber change. At 15 months, in terms of dietary fat adoption, 37% ($n = 62$) were categorized as maintainers or late adopters, 39% ($n = 64$) were categorized as relapsers and 23% ($n = 38$) were non-adopters. For dietary fiber adoption, we found that 44% ($n = 78$) were categorized as maintainers or late adopters, 35% ($n = 62$) were relapsers and 21% ($n = 37$) were non-adopters. There were no statistically significant differences in the proportion of each adopter status by intervention condition.

Intervention implementation

Intervention components were examined to assess dose received and dose delivered. A summary of the results is presented in Table II by dietary adoption status at 3 and 15 months. The intervention was designed to be implemented over a 14-week period; however, the average length of the intervention was 16 weeks and there were no differences in intervention length between adopters and non-adopters at 3 months. However, differences were observed between the three adoption categories at 15 months for both fat and fiber. Maintainers/late adopters and relapsers of dietary fat change completed the intervention in a shorter period of time than non-adopters ($P \leq 0.05$). Maintainers/late adopters of dietary fiber change completed the intervention in a shorter period of time than relapsers and non-adopters ($P \leq 0.05$).

With respect to dose received, over a third of the women returned eight or more homework assignments. At 3 and 15 months, this was consistent across all adopter categories. The mean impressions score was 2.7 (SD = 0.7; four-point scale) indicating that the women perceived the newsletters as moderately favorable. In terms of effort and support, the women reported expending moderate effort in the intervention activities and receiving moderate support for behavior change. Nearly two-thirds reported sharing their materials with a friend, relative or neighbor.

In the P + N condition, a median of 11 home visits were completed, with each averaging ~45

Table I. Baseline demographic characteristics

Variables	Total sample, $N = 238$	P + N, $n = 120$	N only, $n = 118$	Fat adopters at 3 months	Fiber adopters at 3 months
Mean age (SD)	39.5 (10)	38.6 (10)	40.4 (10)	39.2 (10)	38.9 (10.2)
Median household size (range)	4 (1–11)	4 (1–11)	4 (1–10)	5 (1–11)	5 (1–11)
Mean years in the United States (SD)	16.0 (10.3)	15.2 (10.6)	16.9 (10)	15.5 (9.6)	15.4 (10.3)
% Completed high school	75.6	75.8	75.4	77.1	69.9
% Married	79.2	79.0	79.5	82.9	79.1
% Monthly household income \leq \$2000	58.8	60.3	57.3	58.8	61.6
% Homemakers	50.4	47.5	53.4	60.0	52.2
% Poor or fair self-rated health	56.5	51.7	61.5	52.9	53.3

Table II. Intervention components for total sample and by adopter status at 3-month immediate post-intervention and 15-month follow-up

	Intended delivery	Total study sample (N = 238)	Dietary adopters at 3 months		Dietary adopter status at 15 months					
			Fat (n = 105)	Fiber (n = 72)	Fat			Fiber		
					Maintainers and late adopters (n = 62)	Relapsers (n = 64)	Non-adopters (n = 38)	Maintainers and late adopters (n = 78)	Relapsers (n = 62)	Non-adopters (n = 37)
Implementation: mean no. of weeks of intervention (SD)	14 weeks	16.2 (4.7)	16.6 (3.6)	16.1 (3.3)	16.6 (3.5)	15.9 (2.9)	18.6 (5.5)	15.9 (2.9)	17.2 (4.4)	17.7 (4.9)
Dose received: number of homework assignments returned	10									
% Who returned 8–10		36.8	40.0	44.4	40.6	48.4	28.9	48.7	30.6	36.1
Mean impression of newsletters (SD) ^a		2.7 (0.7)	2.7 (0.6)	2.7 (0.65)	2.6 (0.59)	2.7 (0.65)	2.7 (0.77)	2.8 (0.62)	2.6 (0.61)	2.7 (0.82)
Mean effort put into change (SD) ^b		6.6 (2.4)	6.9 (2.4)	6.6 (2.3)	6.6 (2.4)	6.3 (2.5)	6.8 (2.0)	6.3 (2.4)	6.6 (2.4)	6.8 (2.0)
Mean level of support for change (SD) ^b		6.6 (2.8)	6.5 (2.7)	6.7 (2.7)	6.5 (2.6)	6.6 (2.7)	6.7 (3.3)	6.5 (2.7)	6.6 (2.7)	6.4 (3.3)
% Shared materials with others		65.0	68.0	69.4	66.1	67.7	63.9	64.1	64.4	63.9
Dose delivered in promotora condition						N = 85			N = 91	
Median number of home visits (range)	12 visits	11	11 (0–12)	10 (0–12)	11 (0–12)	12 (0–12)	10 (0–12)	11 (0–12)	10 (0–12)	11 (0–12)
Mean minutes of face contact (SD)	60	44.9 (16.1)	44.1 (14.4)	43.5 (16.9)	46.8 (24.3)	43.3 (14.1)	46.5 (14.5)	46.2 (13.1)	45.2 (18.2)	42.8 (19.0)
Median number of phone calls (range) ^c	0	0	2.5 (1–11)	3 (1–11)	2.5 (1–11)	0	2 (1–7)	3 (1–7)	3 (1–11)	2 (0–2)

^aComposite score reflecting a more favorable impression of the newsletters with a higher impression score.

^bComposite score reflecting mean level of effort in the intervention and mean level of support for behavior change and higher score indicates higher effort/support.

^cBased on 21 women who completed telephone calls instead of face-to-face home visits.

min (see Table II). Although not intended to be delivered by telephone, this modality was implemented when a home visit was not possible in order to maintain contact with the participant. In total, only 21 telephone visits were conducted, lasting a mean of 31 min (SD = 17.3).

Predictors of adoption status at 3- and 15-month follow-up

Predictors of dietary adoption at immediate post-intervention (3 months) are presented in Table III. Married women had a 4.5 times greater odds of behavioral adoption of dietary fat than non-married women. No other variables in the models were significantly associated with behavioral change.

At 15 months, maintainers/late adopters for fat were 4.5 times more likely to be married in comparison with non-adopters and relapsers (see Table IV). Relapsers for dietary fat were more likely to return more homework assignments compared with non-adopters and maintainers/late adopters. In the P + N group only, perceived effort and support to change their behavior predicted dietary fat adoption. Com-

pared with non-adopters, maintainers/late adopters reported less effort expended to change their behavior even though they received more home visits overall. In this same group (P + N), relapsers as compared with non-adopters reported putting less effort into their behavior change and completing the intervention in a longer period of time.

Few predictors of dietary behavioral fiber adoption were observed at 15 months. In the P + N and N group, maintainers/late adopters for fiber completed the intervention in a shorter period of time compared with non-adopters.

Discussion

The purpose of this study was to assess the implementation and dose-response of a nutrition intervention. Results answer the question of intervention fidelity, by reducing the possibility of ‘Type III error’ and confirming that the dietary behavioral adoption observed was due to the intervention. These results support the importance of process evaluation measures to assess intervention fidelity

Table III. Predictors of dietary behavioral adoption at 3-month immediate post-intervention

	Dietary adopters			
	Dietary fat OR (CI)		Dietary fiber OR (CI)	
	P + N only	N and P + N groups	P + N only	N and P + N groups
Demographics				
Age	1.0 (0.9–1.0)	1.0 (0.9–1.0)	1.0 (0.9–1.0)	0.9 (0.9–1.0)
High school educated	0.7 (0.2–2.3)	1.0 (0.5–2.0)	1.4 (0.5–4.0)	1.9 (0.9–3.91)
Married	4.5 (1.4–14.4)**	1.5 (0.7–3.2)	0.9 (0.3–2.7)	0.8 (0.3–1.7)
Employed	0.4 (0.1–1.0)	0.5 (0.3–1.0)	0.8 (0.3–2.0)	0.9 (0.5–1.7)
Household size	1.0 (0.7–1.4)	1.0 (0.8–1.2)	1.1 (0.8–1.4)	1.1 (0.9–1.3)
Implementation factors				
Intervention length	0.9 (0.8–1.1)	0.9 (0.9–1.0)	1.0 (0.8–1.2)	1.0 (0.9–1.1)
Number of homework assignments returned	1.0 (0.8–1.2)	1.0 (0.9–1.2)	1.0 (0.8–1.2)	1.0 (0.9–1.0)
Impressions of newsletters	1.0 (0.4–2.3)	1.2 (0.6–1.7)	0.5 (0.3–1.2)	0.8 (0.5–1.3)
Effort put into change	1.0 (0.8–1.2)	0.9 (0.8–1.0)	1.0 (0.8–1.2)	1.0 (0.9–1.2)
Support for change	0.9 (0.7–1.1)	1.0 (0.9–1.2)	1.1 (0.9–1.3)	1.0 (0.9–1.1)
Sharing of materials	0.5 (0.1–1.5)	1.3 (0.7–2.6)	0.6 (0.2–1.7)	1.1 (0.5–2.1)
Promotora implementation				
Number of telephone visits	0.9 (0.7–1.3)	n/a	1.4 (0.8–2.2)	n/a
Number of home visits	1.2 (0.9–1.5)	n/a	0.9 (0.7–1.1)	n/a

OR, odds ratio; CI, confidence interval; n/a, non-applicable. Significant at ** $P < 0.01$.

Table IV. Results of polychotomous logistic regression examining predictors of dietary behavioral maintenance for fat at the 15-month follow-up

	Dietary behavioral adoption status at 15 months			
	Dietary fat OR (CI)			
	P + N only		N and P + N groups	
	Maintainers and late adopters	Relapsers	Maintainers and late adopters	Relapsers
Demographics				
Age	0.98 (0.9–1.1)	1.0 (0.9–1.1)	1.0 (0.9–1.0)	1.0 (0.9–1.0)
High school education	0.52 (0.5–6.2)	0.32 (0.0–6.0)	1.0 (0.3–3.4)	0.67 (0.2–2.3)
Married	5.0 (0.7–38.1)	2.8 (0.3–23.5)	4.5** (1.4–14.0)	2.8 (1.0–8.3)
Employed	0.22 (0.04–1.3)	0.29 (0.0–2.0)	0.76 (0.3–2.0)	1.0 (0.4–2.7)
Household size	1.3 (0.7–2.4)	1.3 (0.7–2.3)	1.0 (0.7–1.4)	0.89 (0.6–1.2)
Implementation factors				
Intervention length	0.78 (0.6–1.0)	0.65** (0.5–0.9)	0.90 (0.8–1.0)	0.82* (0.7–0.9)
Number of homework assignments returned	1.30 (0.9–1.9)	1.45 (1.0–2.2)	1.0 (0.9–1.2)	1.12* (1.0–1.3)
Impression of the newsletters	0.38 (0.1–1.4)	0.72 (0.2–3.4)	0.72 (0.3–1.6)	1.1 (0.5–2.5)
Effort put into change	0.63* (0.4–0.9)	0.60* (0.4–0.9)	1.0 (0.7–1.2)	0.88 (0.7–1.1)
Support for change	0.75 (0.4–1.2)	0.65 (0.4–1.0)	0.92 (0.8–1.1)	0.92 (0.8–1.1)
Sharing of materials	0.16 (0.0–1.9)	0.23 (0–3.5)	1.16 (0.4–3.2)	1.2 (0.4–3.3)
Promotora implementation				
Number of telephone	0.9 (0.5–1.7)	6.8 (0.0–0.9)	n/a	n/a
Number of home visits	1.49 (1.0–2.3)	1.55 (0.9–2.4)	n/a	n/a

Reference category, non-adopters. Multinomial regression analysis, adjusted for demographic and implementation variables. Significant at ** $P < 0.01$; * $P < 0.05$. OR, odds ratio; CI, confidence interval; n/a, non-applicable.

and the reach of the study to the target audience. Both factors help interpret the study results [49]. Predictors of dietary behavioral adoption were examined at the 3-month immediate post-intervention and at the 15-month follow-up. Women who completed the intervention more closely to the prescribed time frame were more likely to maintain behavioral adoption at 15 months or to be late adopters compared with non-adopters.

Results suggest that the intervention was delivered as intended. High program implementation and reach were evidenced by the number of homework assignments returned; materials were delivered weekly by mail and promotoras completed the home visits to review the newsletters. In cases where the promotoras were unable to conduct home visits, the promotoras implemented phone visits to maintain contact with the participants. By doing so, the program reached the target audience and preserved the design of the intervention. Women liked the print materials,

received support for dietary change and shared intervention materials with others.

Number of home visits was not significantly associated with dietary behavioral adoption. This finding suggests that Latinas may need a higher number of visits or other modes of intervention delivery (e.g. phone calls) to adopt a behavioral change.

Among the P + N group participants, perceived effort and intervention length predicted adoption of a lower fat diet at the 15-month follow-up. However, less perceived effort and shorter intervention length were associated with relapsing or returning to baseline fat intake levels. These results indicate that women in this group could benefit from a longer intervention period. For maintainers/late adopters of fiber, shorter intervention length was the only significant predictor of behavioral adoption. This result suggests that for some women, shorter intervention periods could be an appropriate intervention dose. Eakin *et al.* [40] showed dietary

changes at 6-week and 6-month follow-up with a briefly tailored and face-to-face intervention among Latinos. A possible explanation of the null findings in this study is that women had an already high fiber intake and concentrated their efforts on decreasing the fat intake in their diet.

Being married was associated with immediate and long-term behavioral adoption in fat in the P + N group. It is possible that married women may have more social resources, including support and reinforcement, to change their dietary intake [61, 62]. In light of this result, interventions should take into account the marital status of the participant to target and deliver the health message.

Secretos de la Buena Vida targeted the primary adult female in the home, with the hope that she would share information with other family members and potentially become an agent of change. Many women reported keeping their materials. This made it possible for the women to continue reviewing the materials following active intervention participation, which in turn may have maintained their motivation to change. The women provided favorable reviews of the print materials. This study contributed to process evaluation models by collecting and applying key process evaluation concepts to better comprehend how and why the *Secretos de la Buena Vida* program was effective.

Generalizability is limited to Latinas living in the southwestern part of the United States, with low levels of acculturation, income and education. Using landline telephone numbers registered to Latino-surnamed individuals to select the households and recruit the sample limits the generalizability of the findings. The small sample size may have restricted the ability to find stronger associations. However, the robust outcome measures of the study and the longitudinal design strengthen the associations observed between process evaluation measures and dietary behavioral adoption.

Additional research is needed using different methodological approaches to examine the impact of promotoras on participant behavior change, especially in terms of the quality and quantity of the interactions between the promotora and the participant. Models such as Reach, Efficacy / Effective-

ness, Adoption, Implementation and Maintenance (RE-AIM) [63] can assist to develop comprehensive measures and protocols to collect these data. Studies should emphasize the use of process evaluation models to assess program fidelity to avoid Type III error. These tools enhance our understanding of mediators of change. To our knowledge, there is limited evidence of process evaluation measures conducted in tailored health communications targeting Latinas. This study attempted to fill this gap by demonstrating how to collect, use and interpret data to assess the fidelity of the study.

Funding

National Cancer Institute (5R01 CA 81877-02).

Conflict of interest statement

None declared.

References

1. Benavides-Vaello S. Cultural influences on the dietary practices of Mexican Americans: a review of the literature. *Hispanic Health Care Int* 2005; **3**: 27–35.
2. Satia-Abouta J, Patterson RE, Neuhouser ML *et al.* Dietary acculturation: applications to nutrition research and dietetics. *J Am Diet Assoc* 2002; **102**: 1105–18.
3. Stables GJ, Subar AF, Patterson BH *et al.* Changes in vegetable and fruit consumption and awareness among US adults: results of the 1991 and 1997 5 A Day for Better Health Program surveys. *J Am Diet Assoc* 2002; **102**: 809–17.
4. Neuhouser ML, Thompson B, Coronado GD *et al.* Higher fat intake and lower fruit and vegetables intakes are associated with greater acculturation among Mexicans living in Washington State. *J Am Diet Assoc* 2004; **104**: 51–7.
5. Ayala GX, Baquero B, Klinger S. A systematic review of the relationship between acculturation and diet among Latinos in the United States: implications for future research. *J Am Diet Assoc* 2008; **108**: 1330–44.
6. Cox RH, Parker GG, Watson AC *et al.* Dietary cancer risk of low-income women and change with intervention. *J Am Diet Assoc* 1995; **95**: 1031–4.
7. Flegal KM, Carroll MD, Ogden CL *et al.* Prevalence and trends in obesity among US adults, 1999–2000. *J Am Med Assoc* 2002; **288**: 1723–7.
8. Perez-Escamilla R, Putnik P. The role of acculturation in nutrition, lifestyle, and incidence of type 2 diabetes among Latinos. *J Nutr* 2007; **137**: 860–70.

9. Wenten M, Gilliland FD, Baumgartner K *et al.* Associations of weight, weight change, and body mass with breast cancer risk in Hispanic and non-Hispanic white women. *Ann Epidemiol* 2002; **12**: 435.
10. Singh GK, Siahpush M. Ethnic-immigrant differentials in health behaviors, morbidity, and cause-specific mortality in the United States: an analysis of two national databases. *Hum Biol* 2002; **74**: 83–109.
11. Key TJ, Schatzkin A, Willett WC *et al.* Diet, nutrition and the prevention of cancer. *Public Health Nutr* 2004; **7**: 187–200.
12. Gotay CC. Behavior and cancer prevention. *J Clin Oncol* 2005; **23**: 301–10.
13. Flegal KM, Ogden CL, Carroll MD. Prevalence and trends in overweight in Mexican-American adults and children. *Nutr Rev* 2004; **62**(7 part 2), S144–8.
14. American Cancer Society. *Cancer Facts and Figures for Hispanics/Latinos*. Atlanta, GA: ACS, 2005.
15. Prochaska JO. A transtheoretical model of behavior change: implications for diet interventions. In: Henderson MM, Bowen DJ, DeRoss KK (eds). *Promoting Dietary Change in Communities: Applying Existing Models of Dietary Change to Population-Based Interventions*. Seattle, WA: Fred Hutchinson Cancer Research Center, 1992.
16. Glanz K, Rimer BK, Lewis FM. (eds). *Health Behavior and Health Education Theory, Research and Practice*, 3rd edn. San Francisco, CA: Jossey-Bass, 2002, 583.
17. McGuire WJ. Theoretical foundations of campaigns. In: Rice RE, Atkin CK (eds). *Public Communication Campaigns*, 2nd edn. Newbury Park, CA: Sage, 1989.
18. McGuire W. Public communication as a strategy for inducing health-promoting behavioral change. *Prev Med* 1984; **13**: 299–319.
19. McGuire WJ. Attitudes and attitude change. In: Lindzey G, Aronson E (eds). *Handbook of Social Psychology* vol. 2 3rd edn. New York: Random House, 1985; 233–346.
20. Elder JP, Ayala GX, Campbell NR *et al.* Interpersonal and print nutrition communication for a Spanish dominant Latino population. *Health Psychol* 2005; **24**: 49–57.
21. Ayala GX, Mueller K, Lopez-Madurga E *et al.* Restaurant and food shopping selections among Latino women in Southern California. *J Am Diet Assoc* 2005; **105**: 38–45.
22. Ayala GX, Elder PJ, Campbell NR *et al.* Nutrition communication for a Latino community: formative research foundations. *Fam Community Health* 2001; **24**: 72–87.
23. Elder JP, Ayala GX, Campbell NR *et al.* Long-term effects of Secretos de la Buena Vida: interpersonal and print nutrition communication for Spanish-dominant Latinas. *Prev Med* 2006; **31**: 159–66.
24. Fitzgibbon ML, Stolley MR, Avellone ME *et al.* Involving parents in cancer risk reduction: a program for Hispanic American families. *Health Psychol* 1996; **15**: 413–22.
25. Foreyt JP, Ramirez AG, Cousins JH. Cuidando El Corazon—a weight reduction intervention for Mexican Americans. *Am J Clin Nutr* 1991; **53**(Suppl. 6):1639S–41S.
26. Navarro AM, Senn KL, Kaplan RM *et al.* Por La Vida intervention model for cancer prevention in Latinas. *J Natl Cancer Inst Monogr* 1995; **18**: 137–45.
27. Elder JP, Candelaria J, Woodruff SI *et al.* Initial results of “Language for Health”: cardiovascular disease nutrition education for English-as-a-second language students. *Health Educ Res* 1998; **13**: 567–75.
28. Nestle M, Cowell C. Health promotion for low-income minority groups: the challenge for nutrition education. *Health Educ Res* 1990; **5**: 527–33.
29. Wechsler H, Wernick SM. A social marketing campaign to promote low-fat milk consumption in an inner-city Latino community. *Public Health Rep* 1992; **107**: 202–7.
30. Amezcua C, McAlister AL, Ramirez A *et al.* A Su Salud: health promotion in a Mexican-American border community. In: Bracht N, (ed.). *Health Promotion at the Community Level*. Newbury Park, CA: Sage, 1990, 257–7.
31. Elder JP, Campbell NR, Candelaria JI *et al.* Project Salsa: development and institutionalization of a nutritional health promotion project in a Latino community. *Am J Health Promot* 1998; **12**: 391–401.
32. Vazquez IM, Millen B, Bissett L *et al.* Buena Alimentacion, Buena Salud: a preventive nutrition intervention in Caribbean Latinos with type 2 diabetes. *Am J Health Promot* 1998; **13**: 116–9.
33. Campbell M, DeVellis B, Strecher VJ *et al.* Improving dietary behavior: the effectiveness of tailored messages in primary care settings. *Am J Public Health* 1994; **84**: 783–7.
34. Campbell MK, Honess-Morreale L, Farrell D *et al.* A tailored multimedia nutrition education pilot program for low-income women receiving food assistance. *Health Educ Res* 1999; **14**: 257–67.
35. Skinner CS, Campbell MK, Rimer BK *et al.* How effective is tailored print communication? *Ann Behav Med* 1999; **21**: 290–8.
36. Pestano-Binghay E, Reis J, Walters M. Nutrition education issues for minority parents: a needs assessment. *J Nutr Educ* 1993; **25**: 144–6.
37. Albright CL, Bruce B, Howard-Pitney B *et al.* Development of a curriculum to lower dietary fat intake in a multiethnic population with low literacy skills. *J Nutr Educ* 1997; **29**: 215–23.
38. Kreuter MW, Strecher VJ, Glassman B. One size does not fit all: the case for tailoring print materials. *Ann Behav Med* 1999; **21**: 276–83.
39. Kreuter MW, Wray RJ. Tailored and targeted health communication: strategies for enhancing information relevance. *Am J Health Behav* 2003; **27**(Suppl. 3):S227–32.
40. Eakin EG, Bull SS, Riley KM *et al.* Resources for health: a primary-care-based diet and physical activity intervention targeting urban Latinos with multiple chronic conditions. *Health Psychol* 2007; **26**: 392–400.
41. Ryan GL, Skinner SC, Farrell D *et al.* Examining the boundaries of tailoring: the utility of tailoring versus targeting mammography interventions for two distinct populations. *Health Educ Res* 2001; **16**: 555–66.
42. Glanz K, Patterson RE, Kristal AR *et al.* Stages of change in adopting healthy diets: fat, fiber, and correlates of nutrient intake. *Health Educ Q* 1994; **21**: 499–519.
43. Earp JA, Viadro CI, Vincus AA *et al.* Lay health advisors: a strategy for getting the word out about breast cancer. *Health Educ Behav* 1997; **24**: 432–51.
44. Swider SM. Outcome effectiveness of community health workers: an integrative literature review. *Public Health Nurs* 2002; **19**: 11–20.
45. Campbell MK, Honess-Morreale DF, Carbone E *et al.* The North Carolina Black Churches United for Better Health Project: intervention and process evaluation. *Health Educ Behav* 2000; **27**: 241–53.

46. Scheirer MA. Designing and using process evaluation. In: Wholey JS, Hatry HP, Newcomer KE (eds). *Handbook of Practical Programme Evaluation*. San Francisco, CA: Jossey-Bass, 1994, 40–68.
47. Rhodes SD, Foley KL, Zometa CS *et al.* Lay health advisor interventions among Hispanics/Latinos: a qualitative systematic review. *Am J Prev Med* 2007; **33**: 418–27.
48. Earp JA, Flax VL. “What lay health advisors do: an evaluation of advisors’ activities”. *Cancer Pract* 1999; **7**: 16–21.
49. Steckler A, Linnan L. (eds). *Process Evaluation for Public Health Interventions and Research*. San Francisco, CA: Jossey-Bass, 2002.
50. Baranowski T, Stables G. Process evaluations of the 5-a-day projects. *Health Educ Behav* 2000; **27**: 157–66.
51. Eng E, Young R. Lay health advisors as community change agents. *Fam Community Health* 1992; **15**: 24–40.
52. Elder JP. Reaching out the America’s immigrants: community health advisors and health communication. *Am J Health Behav* 2003; **27**(Suppl. 3):S197–205.
53. Basch CE, Slipecevic EM, Gold RS *et al.* Avoiding type III errors in health education program evaluations: a case study. *Health Educ Q* 1985; **12**: 315–31.
54. Pan American Health Organization (PAHO). *Health in the Americas*. 2007. Available at: <http://www.paho.org/hia/index.html> (last accessed 10 March 2008).
55. Ayala GX, Elder JP, Campbell NR *et al.* Correlates of body mass index and waist-to-hip ratio among Mexican women in the United States: implications for intervention development. *Womens Health Issues* 2004; **14**: 155–64.
56. Laforge RG, Greene GW, Prochaska JO. Psychosocial factors influencing low fruit and vegetable consumption. *J Behav Med* 1994; **17**: 361–74.
57. Elder JP, Ayala GX, Slymen DJ *et al.* Evaluating psychosocial and behavioral mechanisms of change in a tailored communication intervention. *Health Educ Behav*. 2007; epub ahead of print, doi: 10.1117/1090198107308373.
58. Cypel YS, Guenther PM, Petot GJ. Validity of portion size measurement aids: a review. *J Am Diet Assoc* 1997; **97**: 289–92.
59. Lanza E, Schatzkin A, Daston C *et al.* Implementation of a 4-y, high-fiber, high-fruit-and-vegetable, low-fat dietary intervention: results of dietary changes in the Polyp Prevention Trial. *Am J Clin Nutr* 2001; **74**: 387–401.
60. Finnegan JR, Rooney B, Viswanath K *et al.* Process evaluation of a home-based program to reduce diet-related cancer risk: the WIN at Home Series. *Health Educ Q* 1992; **19**: 233–48.
61. Waldron I, Hughes ME, Brooks TL. Marriage protection and marriage selection. Prospective evidence for reciprocal effects of marital status and health. *Soc Sci Med* 1996; **43**: 113–23.
62. Williams K, Umberson D. Marital status, marital transitions, and health: a gendered life course perspective. *J Health Soc Behav* 2004; **45**: 81–98.
63. Glasgow RE, Vogt TM, Boles SM. Evaluating the public health impact of health promotion interventions: the RE-AIM framework. *Am J Public Health* 1999; **89**: 1323–7.

Received on June 20, 2008; accepted on February 27, 2009