Multi-level Barriers for Healthy Eating and Fruit and Vegetable Consumption among Hispanic Women Participating in a Healthy Eating Intervention: Findings from the *Nuestras Comidas* Project.

Rekha Ravindran

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Linda Ko
Hendrika Meischke

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Abstract

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Rekha Ravindran

Chair of the Supervisory Committee:
Linda Ko, MS, MPH, PhD
Department of Health Services

As obesity rates rise in the Hispanic community, particularly among children, there is a strong need to develop innovative interventions that effectively address multi-level barriers and increase healthy eating among this population. This study aims to assess the impact of Nuestras Comidas, a short, 8 week pilot program targeting Hispanic women, in changing perceptions of different multi-level barriers and increasing fruit and vegetable consumption among participants. Using a pre-/post-test design, responses to pre- and post-intervention surveys were compared for 35 program participants. Results indicate that there was a statistically significant improvement in perceptions around the ability to eat healthy food (mean difference=4.06; p=0.0004), outcome expectations of healthy eating (mean difference=0.77; p=0.0006), other general barriers (mean difference=1.24; p=0.0001), and levels of social support (mean difference=1.43; p=0.0013). Knowledge around dietary recommendations for fruit and vegetable consumption (mean difference=0.43; p=0.06) trended toward statistically significant improvement from pre- to post-intervention. Fruit (mean difference= 1.4; p=0.0001) and vegetable (mean difference=1.06; p=0.0004) consumption also had a statistically significant improvement from pre- to post-intervention. The findings indicate that Nuestras Comidas had a positive impact on fruit and

vegetable consumption and highlight the needs for innovative, community-based, culturally appropriate interventions to improve healthy eating.

INTRODUCTION

Background
Hispanic youth represent the largest minority group of children and also has higher rates of obesity when compared to other ethnic groups; recent data show that 22.3% of girls and 27.1% of boys of Mexican-American descent are considered obese (Alexander et al., 2014; Burley et al., 2009; Lutfiyya et al., 2008). Children who are overweight are more likely to be overweight or obese adults, which increases the risk for chronic diseases such as hypertension and diabetes and highlights the importance of intervening as early as possible (Burley et al., 2009; Lutfiyya et al., 2008). There are also significant short-term effects of childhood obesity, such as stunted growth, and psychological effects, such as increased loneliness and depression (Lutfiyya et al., 2008).

While many factors play a role in the development of obesity, nutrition is considered a strong indicator of weight status (Odoms-Young et al., 2014). Often the primary cook for the family, mothers are thought to provide important avenues of promoting behavior change (White et al., 2010). However, Hispanic women themselves also face increased rates of obesity; 75.5% of Mexican-American women greater than 20 years of age are overweight or obese compared to 58.0% of non-Hispanic white women, according to 2004 data (White et al., 2010).

There have been some previous programs that focus on obesity reduction and nutrition among the Hispanic population. One such intervention promoted healthy eating among diabetic Hispanics through the involvement of ethnic foods and home-based activities in a group setting (Vazquez et al., 1998). In this randomized controlled trial (RCT), results showed that the intervention group significantly increased in energy and decreased in caloric intake compared to the control group (Vazquez et al., 1998). However, the intervention primarily focused on promoting healthy eating for disease management among Hispanic diabetics and did not examine whether it also influenced childhood obesity. There have been few examples of community-based interventions that specifically focus on Hispanic women to influence family nutritional intake. Research does provide guidance on potential multi-level barriers that limit healthy eating among this population.

Multi-level Barriers
Multiple variables have been associated with unhealthy eating, specifically at the intra-individual and inter-personal level (Terán et al., 2002; White et al., 2010; Yeh et al., 2008). In the intra-individual level, lack of knowledge about how to prepare nutritious meals with unknown ingredients was cited as a psychosocial barrier for healthy eating (White et al., 2010; Yeh et al., 2008). For example, although Hispanic women reported knowing how to cook meals using the types of fruits and vegetables available from their home countries, they reported lacking knowledge on how to use different produce from the US to replicate the meals from their home

country when the same ingredients were unavailable (Yeh et al., 2008). Low food efficacy or confidence in preparing healthy foods was also described by Hispanic women (White et al., 2010). A qualitative study conducted among 31 Hispanic women around experiences with healthy eating showed that over half of Hispanic women had low confidence in their ability to cook healthy food and find healthy foods in the store (White et al., 2010).

Inter-personal factors such as social support also impact healthy eating (Terán et al., 2002; White et al., 2010; Yeh et al., 2008). What women cook and eat is influenced by their social networks and women who are embedded in a social network who do not enjoy healthy food are more likely to be influenced by their social network's eating habits (Terán et al., 2002). Results from the same qualitative study showed that about half of the women stated that their families did not enjoy healthy food as they associated healthy food with not having a good taste and their family's eating preference affected their own cooking and eating habits (White et al., 2010). Lack of strong social support, from both family members and friend networks, hinders healthy eating and ultimately increases the risk of obesity (Terán et al., 2002).

Research shows that lower income and lack of time also impacted healthy eating at the individual level (White et al., 2010; Yeh et al., 2008). Lack of time and difficulty finding reliable transportation were cited as barriers for individuals to engage in healthy eating (White et al., 2010). Though all 31 participants in the focus group were interested in learning how to choose and prepare healthier foods, many women felt they could not attend cooking classes because they could not afford childcare (White et al., 2010). Purchase of fruits and vegetables were cited as costing more and spoiling quicker than other kinds of food, making it difficult to justify the expense given lower incomes (Yeh et al., 2008).

Demographic factors have also been shown to influence diet quality, where younger age, less educational attainment, and lower income were associated with higher rates of unhealthy eating (Ferranti et al., 2013). Additionally, levels of acculturation was associated with healthy eating where women who reported lower levels of acculturation in the United States and continue practicing cultural traditions had healthier eating practices (Terán et al., 2002). Language use is associated with level of acculturation, where lower English proficiency is correlated with lower levels of acculturation (Gutierrez et al., 2009). With low levels of acculturation, traditional cooking practices, which include more culturally-appropriate fruits and vegetables, are often maintained (Yeh et al., 2008).

Theoretical Framework and Conceptual Model
Nuestras Comidas is a brief pilot intervention program aimed at increasing fruit and vegetable consumption among Hispanic women. Fruit and vegetable consumption is an important proxy for healthy eating and factor in obesity prevention (Yeh et al., 2008). It has also been tied to

better health outcomes, including lower risk of cancers and other chronic disease, and is an integral part of healthy diets (Campbell et al., 2008).

This intervention was developed with Albert Bandura's "Social Cognitive Theory" (SCT). SCT describes how human behavior is influenced by three concepts: cognitive, environmental, and behavioral (Bandura, 1977). These concepts interact with each other to motivate behavior change (reciprocal determinism). Within each concept are constructs that serve to influence behavior change in multiple ways.

Cognitive refers to an individual's knowledge, which can be increased through observational learning by viewing role model behavior, increasing outcome expectations by discussing the outcomes of a behavior, and increasing outcome expectancies through describing the positive values of a behavior. Through these activities, one's personal knowledge of all aspects of a behavior will increase and therefore motivate behavior change.

Environmental refers to outside factors, including levels of social support and norms, which can be influenced by the social environment through interacting with other participants and improving the situational environment by promoting healthier norms. By engaging the environment, individuals can gain support from each other as they engage in different decisions.

Behavioral refers to an individual's ability, which can be affected by increasing behavior capability via providing specific feedback, reinforcement through giving opportunities for practice, and increasing food efficacy or perceived abilities, specifically around healthy eating. Through increasing confidence, individuals can feel capable of making healthier choices.

The intervention activities of *Nuestras Comidas* were mapped to specific SCT constructs (Table 1).

Table 1: SCT constructs and associated intervention activity*

SCT Concept	SCT Construct	Operationalized	Intervention Activity
Cognitive	Observational Learning	Knowledge, Barriers	Bilingual (Spanish-English) role models, group discussions on what is healthy and what is not.
	Outcome Expectations	Food Outcomes, Social Support	Group discussions on where they want to be after completing the program.
	Outcome Expectancies	Food Outcomes, Social Support	Group discussions on positive values of healthy eating and healthy cooking.
Environmental	Social Environment	Social Support	Interaction with other participants, food baskets
	Situational	Barriers, Social Support	Provide healthful norm by

	Environment		providing healthy food and healthy eating environment.
Behavioral	Behavior Capability	Knowledge, Barriers	Nutrition seminar (information and feedback), cooking demonstrations, newsletters.
	Reinforcement	Food Efficacy	Food baskets, consistent feedback from program staff and other participants.
	Self-efficacy	Food Efficacy	Skill building through nutrition seminar and cook demonstrations, feedback on home trials, group's efficacy.

*Adapted from Dr. Linda Ko

Our evaluation design for *Nuestras Comidas* is guided by SCT and considers each of the multi-level barriers operationalized as part of the intervention. Below is the conceptual model that shows the relationship between the multi-level barriers of interest and fruit and vegetable consumption (Figure 1). We also examined the relationship between multiple demographic and acculturation variables on fruit and vegetable consumption as these have been shown in the literature to be predictors of healthy eating (Ferranti et al., 2013; Terán et al., 2002).

We hypothesized that the intervention would have an impact on fruit and vegetable consumption through the multi-level barriers: knowledge, food efficacy, food outcomes, barriers, and social support (White et al., 2010; Yeh et al., 2008). The intervention activities were developed to address these multi-level barriers (Table 1). Our primary outcome variable was fruit and vegetable consumption.
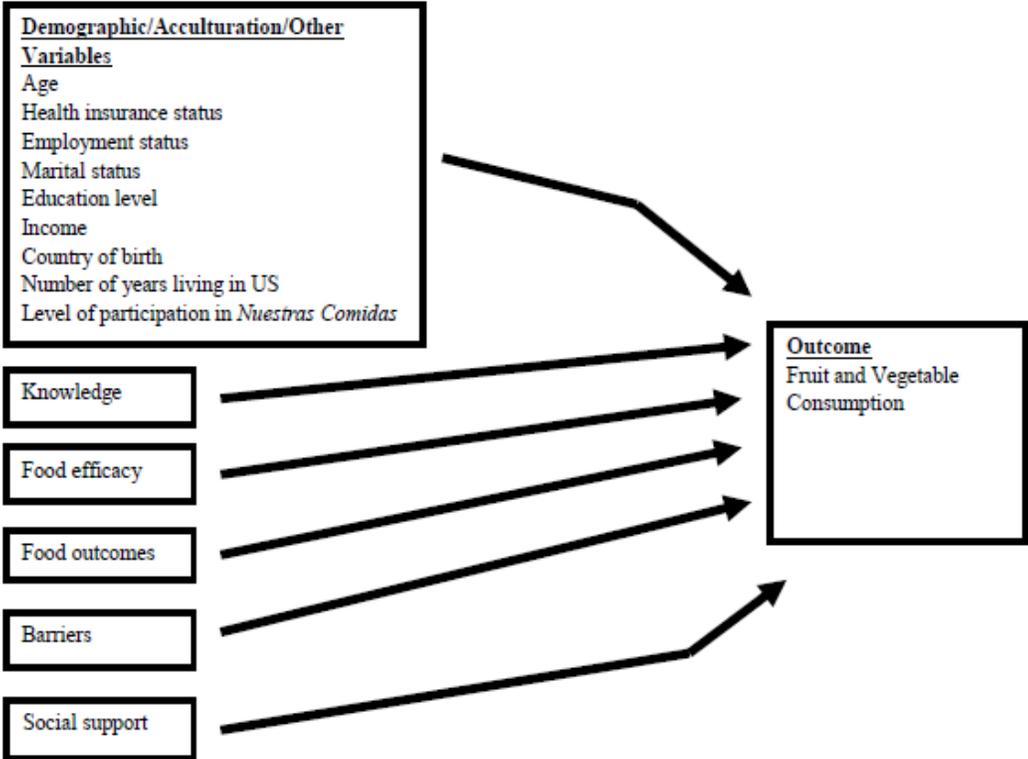
Figure 1: Conceptual model depicting relationships between the variables

The Present Study
The purpose of the present study is to evaluate the impact of *Nuestras Comidas* on multi-level barriers and fruit and vegetable consumption. It had two primary aims:

Aim 1: To examine change in multi-level barrier scores pre- (baseline) and post- (follow-up) participation in *Nuestras Comidas*.
Hypothesis 1: Participants will be more likely to report higher mean scores (indicating decreased multi-level barriers) on the post-intervention survey compared to the pre-intervention survey.

Aim 2: To determine change in servings of fruits and vegetables pre- (baseline) and post- (follow-up) participation in *Nuestras Comidas*.
Hypothesis 2: Participants will be more likely to report higher levels of fruit and vegetable consumption post-intervention compared to pre-intervention.

METHODS

Study Design
This is a secondary analysis of data. Data comes from a brief pilot intervention study entitled *Nuestras Comidas*. The evaluation of the intervention was designed using the pre/post-test methodology and quantitative data was derived from survey questions. Bilingual (Spanish-English) staff members administered the baseline (pre) and the follow-up (post) survey. Questions from the survey came from previously tested and validated questions (Anderson et al., 2007; Campbell et al., 2008; Subar et al., 1995). Measures of interest to this current study included fruit and vegetable consumption, multi-level barriers- knowledge, food efficacy, food outcomes, barriers, and social support-, and demographic/acculturation variables.

Parent Study
Nuestras Comidas was a brief 8-week, biweekly session pilot intervention focused on healthy eating and healthy cooking (PI: Linda K. Ko, PhD). The primary objective of this program was to promote healthy eating among Hispanic women by 1) educating participants on nutritional practice using a group discussion approach and lead by a bilingual (Spanish-English) registered dietician (RD), 2) building healthy cooking skills through demonstrations of Hispanic meals, using healthier substitutes for ingredients, and 3) providing a grocery bag containing items used in the demonstrations for at-home practice.

Each session had a focused objective and included 1) discussions about the healthy eating topic of the week (Table 2), 2) cooking demonstrations substituting healthier ingredients to increase confidence in healthy cooking, and 3) distribution of complimentary grocery bags for at-home practice for mastery of skills and to increase access to fruits and vegetables. The discussion portion of the sessions lasted approximately 50 minutes and was followed by cooking demonstrations facilitated by a bilingual (Spanish-English) cook. Social support was encouraged during the tasting sessions after the cooking demonstration.

Table 2: Session Objectives

Session	Objective	Multi-level Barriers
#1	Re-evaluation of individual's value and reasons on healthy eating- outcome expectations	Food Outcomes
#2	Understand importance of consuming fruits and vegetables, obtaining food from natural sources, appropriate portion and serving size- knowledge & self-efficacy	Knowledge, Food Efficacy, Barriers
#3	Know the USDA My Plate recommendations and how to read nutrition labels	Knowledge, Barriers
#4	What does organic mean and how to choose between organic and non-organic food items	Knowledge, Barriers

The research team partnered with El Centro de la Raza, a Hispanic community center located in the South Seattle neighborhood of Beacon Hill, with a fully functional kitchen and discussion space. It was chosen as an appropriate study site since it is a trusted cultural and advocacy organization with strong ties to the local community.

Sample
Eligible participants were 1) 18 years and older, 2) self-identified as Hispanic or Latino, 3) reported speaking English less than "very well" on the US Census English proficiency item, and 4) reported being the main person who cooks for their family. A bilingual (Spanish-English) staff member recruited participants through tear-tab fliers in community agencies, such as El Centro de la Raza and Hispanic grocery stores. Interested individuals contacted the bilingual staff member, who pre-screened each person to ensure they met eligibility criteria. If deemed eligible, participants were asked to respond to a 15-minute baseline survey conducted over the phone. Participants were compensated $20 for their time. The post-intervention survey was conducted by the research staff by phone nine weeks post-program completion. The survey also consisted of open-ended questions that asked about participants' experiences in the program and what could be improved. Participants were compensated $30 for their time.

Measures
 Dependent Variables

Fruit and vegetable consumption was measured pre-/post-intervention using responses to two survey questions. For vegetables: How many servings of vegetables and/or vegetable juices (6 oz.) do you usually have during a single day?" For fruits: "How many servings of fruit and/or fruit juices (6 oz.) do you usually have during a single day?" Response categories included 0, ½, 1, 2, 3, 4, 5, or more than 5. Responses ranged from 0 to 5+ (coded as 1-8) for veggies and 0 to 5+ (coded as 1-8) for fruits.

Independent Variables

"*Level of participation in Nuestras Comidas*" was measured by the number of sessions attended (up to four), assessed from sign-in sheets.

Multi-level Barriers

Survey questions for the five multi-level barriers came from previously pre-tested and validated surveys (Anderson et al., 2007; Campbell et al., 2008; Subar et al., 1995). Five multi-level barriers were measured: knowledge, food efficacy, food outcomes, barriers, and social support, and were assessed through responses from surveys conducted pre-/post-intervention.

"*Knowledge*" measured knowledge of dietary recommendations for fruit and vegetable consumption and consisted of one question: "How many servings of fruits and vegetables should one eat each day for good health?" Response categories included don't know, none, 1-2, 3-4, and 5+. Participants who answered "5 or more" were coded as correct as this answer meets the current consumption guidelines and all other responses as incorrect.

"*Food efficacy*" consisted of five questions assessing participants' perceived confidence to eating fruits and vegetables. Examples included "How sure are you that you can eat at least five servings of fruits and vegetables every day?" (see Appendix 1). Responses were measured on a scale of 0-10. Using Cronbach's alpha, "Food Efficacy" had high internal consistency (alpha=0.86).

"*Food outcomes*" had eighteen questions that assessed what were expected outcomes of healthy eating. Examples included "If you eat healthier foods every day, you expect to be more attractive" (see Appendix 1). Responses were measured on a nominal scale as either yes or no.

"*Barriers*" had nine questions that related to different potential barriers, such as lack of time or costs. Examples included "Your friends and family don't want to eat healthy foods" (see Appendix 1). Responses were measured on a nominal scale as yes, no, or don't know.

"*Social support*" consisted of four questions that looked at what level of support participants could expect from the people close to them. Examples included "If you tried to eat healthier foods, how much could you count on the people close to you to encourage you?" (see

Appendix 1). Responses were on a Likert-type scale ranging from a lot to not at all. Using Cronbach's alpha, "Social Support" had high internal consistency (alpha=0.86).

Other Variables
Demographic Variables

Age was a continuous variable calculated by using the respondent's date of birth and the date of the interview. Age ranged from 22-68 years old but was re-categorized to 18-25, 26-35, 36-45, 46-55, and >55. This is consistent with age categorizations used in other studies (Gjelsvik et al., 2013). Respondents were asked about their health insurance status (including medical insurance, HMOs, and government plans such as Medicare/Medicaid) and measured as yes, no, don't know, or refused. Employment status was collected as: working full time, working part time, self-employed, unemployed, homemaker, retired, unable to work due to poor health or disability, don't know, or refused. Participants could only choose one response. Marital status was collected as: currently married or living with a partner, separated, divorced, widowed, never married, don't know, or refused. Education level was measured as a nominal variable as number of school years completed, grouped as: 0 years, 1-6 years, 7-9 years, 10-12 years, 13 or more years, don't know, or refused. Income was collected as a nominal variable as income levels: less than $20,000, $20,000 up to $39,999, $40,000 up to $59,999, $60,000 up to $79,999, $80,000 up to $99,999, $100,000 or more, don't know, or refused.

Acculturation Variables

Country of birth was measured as a nominal variable. Research has shown that acculturation to the United States is related to citizenship; therefore, those who were born outside of the United States were categorized as foreign-born and those who were born in the United States as native (Fátima et al., 2012). Number of years living in the United States was a nominal variable- responses ranged from 0 years to 24 years with 2 who refused to respond. Measures were categorized as <5, 5–9 yrs, 10–14 years, and 15+ years (Fátima et al., 2012). Level of acculturation has been associated with amount of time living in the United States and associated changes in health outcomes; Hispanic people living in the United States for over 15 years have an increased risk of obesity compared to those who have lived 10-15 years (Fátima et al., 2012; Sussner et al., 2008).

Data Analysis

There were two aims for the analysis of this study. All data analysis used de-identified data and STATA statistical software (version 13). A total of 46 participants completed the baseline survey; data on one person was removed because he did not meet eligibility criteria, another ten did not complete the follow-up survey and were dropped. A total of 35 participants were used in the analysis. Chi-square goodness of fit test was used to assess if there were statistically significant differences in social demographic characteristics of participants (n=35) and drop-outs (n=10).

Cronbach's alpha was used to assess internal consistency for "Food Efficacy" and "Social Support" variables. To evaluate changes in multi-level barriers, we compared responses pre-/post-intervention for scaled aggregates. Bi-variate relationships were tested using Fischer's exact test of significance or one-tailed paired t-tests for continuous variables. Results were presented separately for all five multi-level barriers.

To assess change in fruit and vegetable consumption, we compared levels of fruit and vegetable consumption pre-/post-intervention. Bi-variate relationships were tested using one-tailed paired t-tests. We then used ANOVA to assess how changes in fruit and vegetable consumption were influenced by different participant characteristics, demographics, and acculturation variables, including number of sessions attended, age, country of birth, number of years living in the United States, health insurance status, employment status, marital status, education level, income, country of birth, and number of years living in the United States. Results were presented separately for fruits and vegetables.

RESULTS

A total of 46 participants in *Nuestras Comidas* completed the baseline survey; only 35 were included in our analysis (see Table 3). 97% of completed participants attended 3 or all 4 program sessions and 82% of them were age 45 or under. The majority (77%) did not have health insurance, had household incomes under $40,000 (83%), and were unemployed, a homemaker, or only worked part-time (83%). Most completed participants were currently married or living with a partner (74%) and many had at least a high school-level education (63%). Almost all were foreign-born (94%) but over half had spent at least 10 years in the United States (63%).

When comparing characteristics between participants (n=35) and drop-outs (n=10), they were relatively homogenous and only age (p=0.0462), health insurance status (p=0.0384), and education level (p=0.0053) had nominally statistically significant differences.

Table 3- Social Demographic Characteristics of *Nuestras Comidas* participants (n=35)*

Characteristics		Total n (%)
Level of participation in *Nuestras Comidas*	0 sessions	0 (0)
	1 session	0 (0)
	2 sessions	1 (3)
	3 sessions	6 (17)
	4 sessions	28 (80)
Age**	18-25	7 (21)
	26-35	9 (26)
	36-45	12 (35)

	46-55	5 (15)
	>55	1 (3)
Health Insurance Status	Yes	8 (23)
	No	27 (77)
Employment Status	Working full time	6 (17)
	Working part time	7 (20)
	Self employed	0 (0)
	Unemployed	15 (43)
	Homemaker	7 (20)
	Retired	0 (0)
	Unable to work due to poor health or disability	0 (0)
Marital Status	Currently married or living with a partner	26 (74)
	Separated	2 (6)
	Divorced	2 (6)
	Widowed	0 (0)
	Never married	5 (14)
Education Level	0 years	0 (0)
	1-6 years	5 (14)
	7-9 years	8 (23)
	10-12 years	9 (26)
	13 or more years	13 (37)
Income	Less than $20,000	17 (49)
	$20,000 up to $39,999	12 (34)
	$40,000 up to $59,999	3 (9)
	$60,000 up to $79,999	1 (3)
	$80,000 up to $99,999	0 (0)
	$100,000 or more	0 (0)
	Don't Know	1 (3)
	Refused	1 (3)
Country of Birth	Native	2 (6)
	Foreign-Born	33 (94)
Number of Year in United States***	<5	3 (9)
	5 – 9	9 (27)

	10–14				8 (24)	
	>15				13 (39)	

Aim #1: To examine change in multi-level barrier scores pre- (baseline) and post- (follow-up) participation in *Nuestras Comidas*.

For Knowledge, 29% of participants correctly identified the dietary recommendations for fruit and vegetable consumption pre-intervention and 71% responded correctly post-intervention; there was a mean 43% increase in correct responses from pre- to post-intervention. However, there was not a statistically significant difference in knowledge from pre- to post-intervention (p=0.06). For Food Efficacy, pre-intervention survey responses ranged from 8-50 and post-intervention responses ranged from 27-50. Overall scores improved by a mean difference of 4.06 points. There was statistically significant differences in Food Efficacy (p=0.0004) from pre- to post-intervention. For Food Outcomes, pre-intervention survey responses ranged from 16-24 and post-test responses ranged from 21-24. Overall scores improved by a mean difference of 0.77 points. There was statistically significant differences in Food Outcomes (p=0.0006) from pre- to post-intervention. For Barriers, pre-intervention survey responses ranged from 10-16 and post-intervention responses ranged from 13-16. Overall scores improved by a mean difference of 1.24 points. There was statistically significant differences in Barriers (p=0.0001) from pre- to post-intervention. For Social Support, pre-intervention survey responses ranged from 8-16 and post-intervention responses ranged from 8-16. Overall scores improved by a mean difference of 1.43 points. There was statistically significant differences in Social Support (p=0.0013) from pre- to post-intervention (see Table 4).

Table 4- Values of Multi-level Barriers Pre/Posttest: Knowledge, Food Efficacy, Food Outcomes, Barriers, Social Support (n=35)

Variables	*Pretest* *n=35*		*Posttest* *n=35*		*Change*	*p-value*
	Mean $\pm$ SD	*Range*	*Mean $\pm$ SD*	*Range*	*Mean $\pm$ SD*	
Knowledge	0.29 +/- 0.40	0-1	0.71 +/- 0.45	0-1	0.43 +/- 0.60	p=0.06*
Food Efficacy	40.31 +/- 8.39	8-50	44.37 +/- 6.22	27-50	4.06 +/-6.56	p=0.0004**
Food Outcomes	22.71 +/-1.36	16-24	23.49 +/- 0.85	21-24	0.77 +/-1.29	p=0.0006**
Barriers	13.73 +/-1.75	10-16	14.97+/- 1.02	13-16	1.24+/-1.66	p=0.0001**
Social Support	12.86 +/- 2.51	8-16	14.29 +/-2.20	8-16	1.43 +/-2.59	p=0.0013**

* Fischer's exact

**one-tailed paired t-test

Aim #2: To determine change in servings of fruits and vegetables pre- (baseline) and post-(follow-up) participation in *Nuestras Comidas*.

For fruit consumption, pre-intervention survey responses ranged from 1-7 and post-intervention responses ranged from 1-8. Overall scores improved by a mean of 1.4 points. Using one-tailed paired t-tests, there was significant differences in fruit consumption (p=0.0001) from pre- to post-intervention. For vegetable consumption, pre-intervention survey responses ranged from 1-8 and post-intervention responses ranged from 3-8. Overall scores improved by a mean of 1.06 points. Using one-tailed paired t-tests, there was significant differences in vegetable consumption (p=0.0004) from pre- to post-intervention (see Table 5). Using ANOVA, number of years in the United States was the only participant characteristic that had a statistically significant effect on change in fruit consumption. All other participant characteristics, including number of sessions attended, demographics (age, health insurance status, employment status, marital status, educational level, and income), and acculturation variables (country of birth and number of years in the United States) did not have a statistically significant effect on change in fruit and vegetable consumption.

Table 5- Values of Fruit and Vegetable Consumption Pre/Posttest (n=35)

Variables	Pretest n=35		Posttest n=35		Change	p-value
	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD	
Fruit Consumption	3.6 ± 1.61	1-7	5 ± 1.66	1-8	1.4 ± 1.96	p=0.0001*
Vegetable Consumption	3.86 ± 1.35	1-8	4.91 ± 1.62	3-8	1.06 ± 1.70	p=0.0004*

* one-tailed paired t-test

DISCUSSION

This descriptive analysis evaluation aims to assess the effect of a nutrition program on multi-level barriers and fruit and vegetable consumption among Hispanic women. While knowledge around dietary recommendations for fruit and vegetable consumption did not have a statistically significant improvement from pre- to post-intervention (though there was a strong trend in a positive direction), perceptions around the ability to eat healthy food, outcome expectations of healthy eating, other general barriers, and levels of social support all had a statistically significant increase. In order to increase healthy eating, it is important to reduce these multi-level barriers. The results of this study provide evidence that *Nuestras Comidas*, a short culturally appropriate nutrition program that includes discussions, cooking demonstrations, and grocery takeaways, can have a positive effect on perceptions around multi-level barriers and fruit and vegetable consumption for Hispanic women.

Fruit and vegetable consumption also had a statistically significant improvement from pre- to post-intervention, providing evidence that the program had a positive effect on healthy eating among Hispanic women. A potential concern was whether certain demographic or acculturation variables had a disproportionate effect on the outcomes. However, only "number of years in the United States" had a nominally statistically significant effect on mean level of fruit change, where participants who had lived in the United States for 5-9 years had the most improvement in mean fruit change scores. Research shows that number of years in the United States is positively correlated with levels of acculturation (Fátima et al., 2012; Sussner et al., 2008). Research also shows that lower levels of acculturation are related to higher consumption of fruits (Terán et al., 2002). The higher magnitude increase for participants who lived in the United States for 5-9 years is at odds with findings from previous research. There is some suggestion that too little or too much acculturation can have damaging psychological effects but this finding warrants further investigation (Terán et al., 2002). Other participant characteristics did not have a statistically significant effect, likely due to the relatively homogenous characteristics of program participants.

While we hypothesized that the different multi-level barriers- knowledge, food efficacy, food outcomes, barriers, and social support- affected fruit and vegetable consumption in our conceptual model (see Figure 1), our small sample size (n=35) gave us little power to analyze this relationship, which should be studied in future research. For the next steps, it would be interesting to expand the scale of the program to include more women and randomize participants to a control or treatment arm. This will allow for more rigorous evaluation and an opportunity to assess the long-term effects with a larger study size. Nevertheless, the success of *Nuestras Comidas* shows that an intervention with a strong theoretical framework, even with a limited sample size, can still have a positive impact.

Limitations

Several limitations should be considered. Since this was a pilot study, the sample size of completed participants (n=35) was small and affects the generalizability of the results. Despite the small sample size, the impact of the intervention was still strong enough to have statistically significant results. We also dropped participants (n=10) who did not complete the follow-up survey. However, including them in the analysis would likely make the outcomes overly conservative. All survey data used in this evaluation was based on self-report, potentially biasing the outcomes, and there were potential risks that the questionnaire itself influenced behaviors and resulted in higher scores. The use of a pre-tested, validated survey tool should have minimized some of these issues. We also conducted multiple tests to assess the statistical significance of different relationships. This increases the risk of multiple testing bias, where comparison groups appear to have a statistically significant relationship due to random chance, but we only completed tests that were necessary. Since we hypothesized increases on all measured variables, we conducted one-tailed paired t-tests, which may also erroneously detect an effect. The relationships were highly statistically significant, limiting this risk. The scaling of the fruit and

vegetable consumption variables assumed equal differences for each unit change. However, this was not an accurate reflection of the actual numerical differences between each measure and may bias our results.

Conclusions

As obesity levels increase in the Hispanic community, it becomes increasingly important to develop innovative community-based interventions that address this issue as upstream as possible. Increasing healthy eating for Hispanic women, who often have ownership over household nutritional intake, can have strong effects on the consumption patterns of the entire family. Yet few programs aim to target the specific multi-level barriers faced by Hispanic women and increase healthy eating. The purpose of this descriptive analysis evaluation was to assess the efficacy of such a program, *Nuestras Comidas*, in meeting this need. Despite the small sample size of this pilot program, there were many statistically significant positive effects on both perspectives around multi-level barriers and fruit and vegetable consumption. *Nuestras Comidas* utilized innovation and culturally-appropriate practices, providing strong evidence to invest in future interventions that take this approach.

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APPENDIX

Appendix 1: Measures

MEASURES		
Dependent Variables		
Name	Level of Measurement	Source
FRUIT CONSUMPTION		
Number of servings of fruits and/or fruit juices (6 oz) in a single day	Ratio	Survey
VEGETABLE CONSUMPTION		
Number of servings of vegetables and/or vegetable juices (6 oz) in a single day	Ratio	Survey
Independent Variables		
Name	Level of Measurement	Source
Level of participation in *Nuestras Comidas*	Ordinal (0,1,2,3,4)	Sign-in sheet
Multi-level Barriers		
Name	Level of Measurement	Source
KNOWLEDGE		
How many servings of fruits and vegetables should one eat each day for good health	Nominal (correct/incorrect)	Survey
FOOD EFFICACY		
How sure can eat at least 5 servings of fruits and vegetables every day	Ordinal	Survey
How sure can eat vegetables (like carrot or celery sticks) for a snack	Ordinal	Survey
How sure caneat a fruit for a snack	Ordinal	Survey
How sure canhave a side salad instead of French fries when dining out	Ordinal	Survey
How sure candrink fruit or vegetable juice at meals	Ordinal	Survey
FOOD OUTCOMES		
If you eat healthier foods every day, you expect to have more energy	Nominal (yes/no)	Survey

If you eat healthier foods every day, you expect to lose weight	Nominal (yes/no)	Survey
If you eat healthier foods every day, you expect to feel healthier and happier	Nominal (yes/no)	Survey
If you eat healthier foods every day, you expect to live longer	Nominal (yes/no)	Survey
If you eat healthier foods every day, you expect to feel better in your clothes	Nominal (yes/no)	Survey
If you eat healthier foods every day, you expect to have improved health	Nominal (yes/no)	Survey
If you eat healthier foods every day, you expect to miss eating the foods you love	Nominal (yes/no)	Survey
If you eat healthier foods every day, you expect shopping for healthy foods will be a lot of trouble	Nominal (yes/no)	Survey
If you eat healthier foods every day, you expect the food you eat will not taste good	Nominal (yes/no)	Survey
If you eat healthier foods every day, you expect it will take too long to prepare meals and snacks -	Nominal (yes/no)	Survey
If you eat healthier foods every day, you expect to be more attractive	Nominal (yes/no)	Survey
If you eat healthier foods every day, you expect you won't be able to stick with it, you will go back to your old habits	Nominal (yes/no)	Survey
BARRIERS		
Your friends and family don't want to eat healthy foods	Nominal (yes/no/don't know)	Survey
You don't keep healthy foods in the house	Nominal (yes/no/don't know)	Survey
Healthy foods don't taste good	Nominal (yes/no/don't know)	Survey
You don't have time to make healthy foods	Nominal (yes/no/don't know)	Survey
Healthy foods cost too much	Nominal (yes/no/don't know)	Survey
You will still be hungry if you eat healthy foods	Nominal (yes/no/don't know)	Survey
You don't know how to prepare foods in a healthy way	Nominal (yes/no/don't know)	Survey
Eating healthy foods will help you control	Nominal (yes/no/don't know)	Survey

your weight		
SOCIAL SUPPORT		
How much could you count on the people close to you to encourage you to eat healthy	Ordinal (a lot, some, not at all, don't know, N/A)	Survey
How much could you count on the people close to you to tell you about healthier foods and how to prepare them	Ordinal (a lot, some, not at all, don't know, N/A)	Survey
How much could you count on the people close to you to prepare healthier foods with or for you	Ordinal (a lot, some, not at all, don't know, N/A)	Survey
How much could you count on the people close to you to eat healthier foods with you	Ordinal (a lot, some, not at all, don't know, N/A)	Survey
Demographic Variables		
Name	Level of Measurement	Source
Age	Continuous	Survey
Health insurance status	Nominal (yes/no)	Survey
Employment status	Nominal (yes/no)	Survey
Civil status	Nominal	Survey
Educational achievement	Nominal	Survey
Household income	Nominal	Survey
Acculturation Variables		
Name	Level of Measurement	Source
Country of birth	Nominal	Survey
Number of years living in United States	Continuous	Survey