Educational Interventions to Promote Healthy Nutrition and Physical Activity Among Older Chinese Americans: A Cluster-Randomized Trial

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Objectives. To evaluate the efficacy of an in-language intervention of 2 lectures plus printed materials versus printed materials alone on knowledge and adherence to nutrition and physical activity guidelines among older Chinese Americans in San Francisco, California.

Methods. From August 2010 to September 2013, we randomized 756 Chinese Americans aged 50 to 75 years to either lectures plus print (n = 361) or print (n = 357). Clusters were the participants recruited by each lay health worker. Intervention outcomes were changes in knowledge of recommended vegetable intake, fruit intake, and physical activity level and adherence to those recommendations from pre- to 6 months postintervention.

Results. The retention rate was 99%. At baseline, knowledge and adherence to recommendations were low. Print yielded increases in knowledge of recommended vegetable intake and physical activity level and adherence to fruit intake and physical activity recommendations. Lectures plus print had significant increases in all 6 outcomes. In multivariable models, lectures plus print was superior to print for knowledge of vegetable (adjusted odds ratio [AOR] = 12.61; 95% confidence interval [CI] = 6.50, 24.45) and fruit (AOR = 16.16; 95% CI = 5.61, 46.51) intake recommendations and adherence to vegetable intake recommendations (AOR = 5.53; 95% CI = 1.96, 15.58).

Conclusions. In-language print materials, alone and combined with lectures, increased nutrition and physical activity knowledge and behaviors among older Chinese Americans. (*Am J Public Health.* 2016;106:1092–1098. doi:10.2105/AJPH.2016.303111)

Asian Americans constitute the fastest growing racial/ethnic group in the United States.[1] The largest group is Chinese, 69% of whom are immigrants and 46% of whom have limited English proficiency (LEP).[2] Chinese Americans have low physical activity levels[3,4] and eat less than the recommended amounts of vegetables and fruits.[5] Thus, they may have an increased risk of chronic diseases, such as obesity, cancer, diabetes mellitus, and cardiovascular disease.[6–11] Improving healthy nutrition and physical activity (NPA) is a public health priority in this rapidly growing population.

Culturally relevant and linguistically appropriate interventions targeting Chinese Americans are needed because many have LEP and low levels of health literacy,[12–14] but there is a lack of rigorous research on interventions to address NPA among Asian Americans in general and Chinese Americans in particular. A systematic review of lifestyle interventions for Asian Americans found only 7 randomized control trials (RCTs), only 2 of which had a sample size of more than 100.[14] Previous NPA interventions in Asian Americans have focused on print-[15] or lecture-based education alone.[16,17] There has been no RCT that compared an NPA lecture–based intervention to NPA printed materials among Asian Americans.

Through a community-based participatory research partnership formed by an academic medical center, an undergraduate university, and a Chinese community–based organization in San Francisco, California, we developed a lecture-based intervention and print materials to deliver culturally relevant, in-language NPA messages. Using a cluster RCT design, we aimed to compare the effects of this lecture-based intervention combined with Chinese-language written materials with those of Chinese-language written materials only in a sample of older Chinese American immigrants.

METHODS

We used a parallel group cluster RCT design with a 1-to-1 allocation ratio to test the effectiveness of an intervention consisting of 2 Chinese-language NPA lectures combined with Chinese-language print materials (lectures

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plus print or intervention group) compared with the effectiveness of the same print materials only (print or comparison group; Figure A, available as a supplement to the online version of this article at http://www.ajph.org). This study was registered in the ClinicalTrials.gov registry (NCT NCT00947206). The study period was from October 2010 to April 2014. The study's educational materials are available for download at www.asianarch.org.

From 2010 to 2013, the Chinese community–based organization recruited 58 lay health workers (LHWs), each of whom in turn recruited approximately 15 participants. LHWs were community members trained by the research team to recruit research participants and maintain contact with them to maximize retention in the study. Eligibility criteria for LHWs included self-identifying as Chinese or Chinese American; being aged 35 years or older; being a Cantonese, Mandarin, or English speaker; being able to read Chinese; and intending to live and stay in San Francisco for at least 12 months. Median age of LHWs was 50 years old and 79% were women. LHWs were given sample scripts that included a description of the study and health topics to use in recruiting potential participants.

LHWs submitted a list of eligible participants to the community-based organization project coordinator, who then confirmed participant eligibility according to the following criteria:

1. self-identifying as Chinese or Chinese American;
2. being aged 50 to 75 years;
3. being a Cantonese, Mandarin, or English speaker;
4. intending to live and stay in San Francisco for at least 6 months;
5. there being no other participants in their household; and
6. having no personal history of colorectal cancer (because it was the focus of a parallel RCT).

LHWs received a stipend of $1000 for their 8- to 10-month study involvement. Study participants received $20 after completing the preintervention survey and $30 after completing the postintervention survey 6 months later.

We recruited LHWs and participants in 4 waves between August 2010 and September 2013. The biostatistician used SAS version 9.3 (SAS Institute, Cary, NC) to randomize the LHWs 1 to 1 to the lectures plus print or print-only intervention in blocks of variable size. Within each wave, we stratified LHWs by gender and then randomly assigned them to the lectures plus print group or the print group. We cluster randomized the participants along with their LHW. To reduce bias, research staff and LHWs learned study arm assignments only after the LHW completed participant recruitment.

Lectures Plus Print Intervention and Print Comparison Groups

The lectures plus print group received (1) two 60–90-minute lectures delivered by an instructor in the participants' preferred language (Cantonese, Mandarin, or English) about 2 months apart, (2) 2 cohort maintenance telephone calls from their LHWs about 1 month after each lecture, and (3) printed lecture handouts and a nutrition brochure. The community–academic research team developed the NPA lectures, and a community advisory board reviewed them for cultural and linguistic appropriateness; they were tested in focus groups with community participants who were not enrolled in the study.

The first lecture, titled "How to Eat Smart and Be Active," focused on basic NPA education that was tailored to older Chinese Americans and used culturally appropriate examples for food and physical activity. For example, along with pictures of common fruits and vegetables in the American diet, there were also pictures of fruits such as mango and papaya and vegetables such as bok choy. A rice bowl was used to illustrate serving size measurement for some foods. Tai Chi was included among the recommended physical activities. Tips for cooking included how to minimize some commonly used ingredients in Chinese cooking such as soy sauce, salted fish, and organ meats.

We designed the curriculum to be simple and engaging, with culturally appropriate mnemonic techniques to help participants remember the basic recommendations regarding maintaining a healthy diet and an optimal aerobic physical activity level (which we adapted from the national 2005 Dietary Guidelines of Americans and the 2008 Physical Activity Guidelines, which were the accepted standards at the initiation of the trial).[18,19] For example, lecturers used simple hand gestures with a Chinese poem as a learning aid to help participants recall the recommended number of servings of the basic food groups and recommended number of minutes of aerobic physical activity.

One month after the first lecture, the LHWs called their participants to ask them about their impressions and recall of the first lecture and to remind them to attend the next lecture. The second lecture, titled "Disease Prevention and Health Promotion," included general information on hypertension, hypercholesterolemia, and diabetes mellitus; how they affected Chinese Americans; and how healthy NPA reduced the risks of those conditions. One month after that, LHWs called participants, thanked them for participating, and reminded them that research staff would contact them about the postintervention survey.

The print comparison group received the same print NPA materials. As part of the parallel RCT and for attention control, LHWs delivered 2 small group education sessions on colorectal cancer to participants in this arm (with approximately 5–8 participants in each) about 2 months apart; they made 2 follow-up telephone calls about colorectal cancer about 1 month after each small group session.

Data Collection

The preintervention survey was self-administered in a written format at a community center before the first NPA lecture or first comparison group meeting. About 6 months later, the postintervention survey was self-administered in a written format at the community center. Both surveys required approximately 30 to 45 minutes to complete. The trilingual community–academic research team developed the survey instruments in English and cognitive tested, revised, and then translated them into Chinese.

The survey instrument included sociodemographic characteristics of age, gender, educational attainment, marital status, number of years in the United States, employment status, annual household income, spoken English proficiency, self-rated health, comorbidities, height, weight, and whether they had made any visit to a Western health care provider in the last 12 months. We used 3 items to assess NPA knowledge: (1) knowing that 5 servings of vegetables was recommended

daily, (2) knowing that 4 servings of fruit was recommended daily, and (3) knowing that 150 minutes of at least moderate intensity physical activity was recommended weekly.

We used 3 items to assess self-reported NPA behaviors: (1) the number of servings of vegetables eaten during the previous day, (2) the number of servings of fruit eaten during the previous day, and (3) the duration of at least moderate intensity physical activity during the previous week.

Analysis

We computed descriptive statistics (frequency distributions or means ±SDs, as appropriate) for each independent variable by study arm. We analyzed the data using SAS version 9.3, and we used $P = .05$ as the cutoff level for statistical significance. We compared the study arms with respect to these variables using generalized estimating equations to account for clustering by LHWs (Table 1). We computed each participant's body mass index (BMI; defined as weight in kilograms divided by the square of height in meters) from self-reported weight and height and entered BMI as a continuous variable in models.

On the basis of guidelines from the World Health Organization,[20] we used Asian BMI criteria: overweight was a BMI of 23.00 to 27.49, and obesity was a BMI of 27.50 or greater. To quantify NPA knowledge and behavior outcomes, we computed the percentage of participants who knew the correct answer and the percentage who reported meeting the guidelines at pre- and postintervention in each group.

We computed intraclass correlations for the NPA knowledge and behavior outcomes from variance components estimated using SAS PROC GLM with study arm, time, and their interaction as fixed effects and LHW as a random effect. We tested the primary hypotheses of the NPA intervention effects using generalized estimating equations models to assess outcome changes from pre- to postintervention within and between groups, accounting for clustering by LHW (Tables 2 and 3).

We used multivariable logistic regression models for the outcomes to account for within-LHW clustering with generalized estimating equations, and we adjusted them for

TABLE 1—Sociodemographic and Health Characteristics of Chinese American Participants by Study Group at Enrollment: San Francisco, CA, August 2010 and September 2013

Characteristic	Lectures and Print Materials Intervention Group (n = 365), % or Mean ±SD	Print Materials Only Comparison Group (n = 360), % or Mean ±SD	P[a]
Female	79.2	83.1	.30
Age, y	61.7 ±7.0	62.8 ±6.8	.11
Years in the United States	16.9 ±11.7	17.8 ±12.8	.56
Married	77.0	70.8	.12
Education			.70
< high school diploma or equivalent	69.7	71.4	
≥ high school diploma or equivalent	30.3	28.6	
Employment			.10
Employed	31.8	22.5	
Retired	29.9	38.3	
Other[b]	38.4	39.2	
Self-reported spoken English proficiency			.58
Fluent like native speaker	1.4	2.2	
Well	2.8	2.2	
So-so	29.5	27.5	
Poor	40.8	36.9	
Not at all	25.6	31.1	
Annual household income, $			.44
< 5000	14.3	12.1	
5000 to < 10 000	19.7	17.7	
10 000 to < 20 000	26.3	28.4	
20 000 to < 30 000	11.0	8.4	
30 000 to < 40 000	6.9	5.1	
40 000 to < 50 000	3.0	2.5	
≥ 50 000	4.7	3.1	
Don't know	14.3	22.8	
Saw Western health care provider in last 12 mo	79.7	80.8	.70
Self-reported health status			.89
Excellent	2.2	1.4	
Very good	5.2	6.1	
Good	27.9	27.2	
Fair	56.2	58.9	
Poor	8.5	6.4	
BMI	23.3 ±4.0	24.2 ±3.4	.002
Asian BMI cutpoints,[c] kg/m^2			.009
Underweight, < 18.5	5.5	3.1	
Normal weight, 18.5–22.9	43.7	34.7	
Overweight, 23.0–27.49	40.9	46.7	
Obese, ≥ 27.5	9.9	15.6	

Continued

TABLE 1—*Continued*

Characteristic	Lectures and Print Materials Intervention Group (n = 365), % or Mean ±SD	Print Materials Only Comparison Group (n = 360), % or Mean ±SD	P[a]
Self-reported cardiovascular disease			
Heart disease	3.0	5.0	.16
Stroke	1.9	2.5	.59
Diabetes	15.6	15.1	.84
Hypertension	32.9	39.8	.09
Hyperlipidemia	34.8	35.3	.89
None of the above	35.6	31.9	.43

Note. BMI = body mass index. The sample size was n = 725.
[a]Accounting for lay health worker clustering.
[b]Includes unemployed, students, and homemakers.
[c]According to recommendations by the World Health Organization.[20]

potential confounders, age, gender, education, marital status, number of years in the United States, employment status, income, English proficiency, self-rated health, number of cardiovascular conditions, BMI, and whether they had made any visit to a Western health care provider in the last 12 months (Table 4).

RESULTS

Each of the 58 LHWs recruited on average 15 participants, for a total of 756 enrolled participants. The mean age of the LHWs was 50.6 years (SD = 9.3), and 79.3% were women. All LHWs spoke Cantonese and read Chinese. We ended recruitment when the goal sample size was attained. The overall 6-month retention rate for the study was 99.0%. Participants lost to follow-up (n = 7) did not complete the postintervention survey (Figure A, available as a supplement to the online version of this article at http://www.ajph.org). On review of preintervention surveys, we excluded randomized participants who did not meet the inclusion age criterion from the analysis (n = 30). The final analysis included 718 eligible participants.

Table 1 shows the participant characteristics of both groups, which were similar except that lectures plus print participants had a slightly lower mean BMI than did those in the print group (23.3 kg/m^2 vs 24.2 kg/m^2, respectively; $P = .002$). We used Asian BMI cutpoints[20] and found that the proportion of participants who were overweight or obese was lower in the lectures plus print group (50.8%) than in the print group (62.3%; $P = .009$). More than 60.0% of the sample reported at least 1 comorbidity, such as heart disease, diabetes, or hypertension. At baseline, the median number of servings of vegetables and fruits eaten during the previous day was 2 per person.

Knowledge and Behavior Changes Within Groups

Table 2 shows pre–post changes in the knowledge of NPA recommended guidelines by study group. Knowledge of the recommended vegetable intake (at least 5 servings daily) increased significantly from 2.8% to 35.7% ($P \leq .001$) in the lectures plus print group (n = 361) and from 5.0% to 8.4% ($P = .003$) in the print group (n = 357). Knowledge of the fruit intake recommendation (at least 4 servings daily) increased from 2.8% to 36.3% ($P \leq .001$) in the intervention group versus a nonsignificant change from 3.1% to 3.9% ($P = .51$) in the comparison group.

Knowledge of the physical activity recommendation (at least 150 minutes weekly) increased from 1.1% to 20.2% ($P \leq .001$) in the intervention group versus an increase from 0.3% to 2.5% ($P < .02$) in the comparison group. The intraclass correlations were 0.05 for knowledge of daily vegetable servings, 0.04 for daily fruit servings, and 0.01 for weekly duration of at least moderate physical activity.

Self-reported consumption of at least 5 servings of vegetables daily increased significantly in the lectures plus print group (from 2.2% to 15.2%; $P \leq .001$) but not in the print group (from 3.4% to 4.8%; $P = .31$; Table 3). Both groups reported significant increases for daily consumption of at least 4 servings of fruits daily (9.1% to 22.4%; $P \leq .001$ for the intervention group and 7.3% to 11.5%; $P < .03$ for the comparison group).

TABLE 2—Knowledge of Nutrition and Physical Activity Guidelines at Pre- and Postintervention by Study Group Among Older Chinese Americans: San Francisco, CA, August 2010 and September 2013

	Intervention Group, Lectures and Print Materials, n = 361, Knowledge of Guidelines, %			Comparison Group, Print Materials Only, n = 357, Knowledge of Guidelines, %			
Guideline	Pre	Post	P	Pre	Post	P	Pre–Post Differences Between Group P
Daily vegetable servings, 5	2.8	35.7	≤.001	5.0	8.4	.003	≤.001
Daily fruit servings, 4	2.8	36.3	≤.001	3.1	3.9	.51	≤.001
Weekly duration of at least moderate physical activity, 150 min	1.1	20.2	≤.001	0.3	2.5	.02	≤.001

Note. Percentages took into account lay health worker clustering. Vegetable and fruit intake guidelines were adapted from the 2005 Dietary Guidelines for Americans of the US Department of Health and Human Services and US Department of Agriculture.[18] Physical activity guidelines were adapted from the 2008 Physical Activity Guidelines for Americans of the US Department of Health and Human Services.[19] The sample size was n = 718.

TABLE 3—Self-Reported Behavior Meeting Nutrition and Physical Activity Guidelines at Pre- and Postintervention by Study Group Among Older Chinese Americans: San Francisco, CA, August 2010 and September 2013

Guideline	Intervention, Group Lectures and Print Materials, n = 361, Self-Reported Behavior Meeting Guidelines, %			Comparison Group, Print Materials Only, n = 357, Self-Reported Behavior Meeting Guidelines, %			Pre–Post Differences Between Group *P*
	Pre	Post	*P*	Pre	Post	*P*	
Vegetable intake on previous d of ≥ 5 servings	2.2	15.2	≤ .001	3.4	4.8	.31	≤ .001
Fruit intake on previous d of ≥ 4 servings	9.1	22.4	≤ .001	7.3	11.5	.03	.003
Duration of at least moderate physical activity in the last week of ≥ 150 min	54.9	69.5	≤ .001	54.9	64.7	.001	.20

Note. Percentages took into account lay health worker clustering. Vegetable and fruit intake guidelines adapted from the 2005 Dietary Guidelines for Americans of the US Department of Health and Human Services and US Department of Agriculture.[18] Physical activity guidelines adapted from the 2008 Physical Activity Guidelines for Americans of the US Department of Health and Human Services.[19] The sample size was n = 718.

Similarly, both groups had significant increases in the proportion of those reporting at least 150 minutes of moderate physical activity weekly (54.9% to 69.5%; $P \leq .001$ for the intervention group and 54.9% to 64.7%; $P = .001$ for the comparison group). The intraclass correlations were 0.03 for self-reported daily vegetable intake, 0.03 for daily fruit intake, and 0.06 for weekly physical activity.

Knowledge and Behavior Changes Between Groups

Tables 2 and 3 also show the statistical significance of between-group differences for NPA outcomes (pre–post differences between group *P* values).

The lectures plus print group had significantly greater increases than did the print group in knowledge of recommended vegetable intake, fruit intake, and physical activity (all $P \leq .001$). For self-reported behaviors, the lectures plus print group had significantly greater increases than did the print group in meeting recommendations for vegetable intake ($P \leq .001$) and fruit intake ($P = .003$) but not in physical activity level ($P = .20$).

Multivariable Models of Intervention Effects

Table 4 shows the multivariable models for all 6 outcomes of NPA knowledge and behaviors. After adjusting for sociodemographic and health characteristics, participants in the lectures plus print group had a greater increase than did those in the print group in the odds of knowing the daily vegetable intake recommendation (adjusted odds ratio [AOR] = 12.61; 95% confidence interval [CI] = 6.50, 24.45) and the daily fruit intake recommendation (AOR = 16.16; 95% CI = 5.61, 46.51).

Similarly, the lectures plus print group had a greater increase than did the print group in the odds of meeting the vegetable intake recommendation (AOR = 5.53; 95% CI = 1.96, 15.58). Significant covariates in the multivariable models for each outcome are shown in Table A (available as a supplement to the online version of this article at http://www.ajph.org).

DISCUSSION

To our knowledge, this study is the first RCT of behavioral NPA interventions among Asian Americans and the first RCT that compared the efficacy of 2 such

TABLE 4—Adjusted Intervention Effects on Knowledge of and Self-Reported Behavior Meeting Nutrition and Physical Activity Guidelines Among Older Chinese Americans: San Francisco, CA, August 2010 and September 2013

Guideline	Knowledge of Guidelines, AOR (95% CI)			Meeting Behavioral Guidelines, AOR (95% CI)		
	Daily Vegetable Intake	Daily Fruit Intake	Weekly Physical Activity	Self-Reported Daily Vegetable Intake	Self-Reported Daily Fruit Intake	Self-Reported Weekly Physical Activity
Intervention effect[a]	12.61 (6.50, 24.45)	16.16 (5.61, 46.51)	2.70 (0.31, 23.15)	5.53 (1.96, 15.58)	1.77 (0.99, 3.15)	1.27 (0.89, 1.80)
Post vs pre effect in print comparison group[b]	1.79 (1.20, 2.66)	1.29 (0.60, 2.77)	8.19 (1.18, 56.92)	1.45 (0.72, 2.89)	1.62 (1.02, 2.57)	1.52 (1.16, 1.99)
Post vs pre effect in lectures plus print intervention group[b]	22.50 (13.24, 38.22)	20.80 (9.93, 43.57)	22.08 (8.86, 55.03)	8.00 (3.70, 17.29)	2.86 (2.00, 4.08)	1.93 (1.54, 2.42)

Note. AOR = adjusted odds ratio; CI = confidence interval. Models accounted for lay health worker clustering and were adjusted for additional covariates: years in the United States, self-reported spoken English proficiency, highest education level, and visit to a Western health care provider in last 12 mo. The sample size was n = 700.

[a]The increase in the odds of knowing the guideline or in meeting the guideline for participants in the lectures plus print group compared with those in the print group.

[b]The increase in the odds of knowing the guideline or in meeting the guideline for participants within the same group pre- and postintervention.

interventions in Chinese Americans. In this sample of older Chinese Americans with LEP, those who received Chinese-language printed materials had significant increases in both knowledge of NPA recommendations and self-reported behaviors that met those recommendations at postintervention. Those who received 2 Chinese-language lectures in addition to the print materials also had increases in NPA knowledge and behavior. The combination of lectures plus print materials was superior to print materials alone for knowledge of nutrition guidelines and for behavior meeting such guidelines, although not for knowledge of the physical activity recommendation or for behavior meeting that recommendation.

Baseline rates of knowledge and behavior related to vegetable and fruit intake guidelines (adapted from the 2005 Dietary Guidelines of Americans)[18] were low among the older Chinese Americans, which is consistent with published studies in other racial/ethnic groups.[21,22] Before intervention, our study participants reported eating a median 2 servings of vegetables and 2 servings of fruits during the previous day. This level is slightly higher than that noted among Vietnamese Americans surveyed in California in the mid-1990s[23] and national data reporting that Americans in general have a median intake of vegetables of 1.6 times daily and of fruit of 1.1 times daily.[24] These findings underscore the need for designing and testing interventions that can improve healthy nutrition among Asian Americans.

Printed materials led to small but statistically significant increases of 3.4% in the proportion knowing the vegetable intake recommendation and 1.4% and 4.2%, respectively, in the proportion of those meeting the vegetable and fruit intake recommendations. Adding 2 Chinese-language lectures to our lectures plus print intervention led to substantially larger increases of 32.9% and 33.5%, respectively, in the proportion knowing the vegetable and fruit intake recommendations and 13.0% and 13.3%, respectively, in the proportion meeting vegetable and fruit intake recommendations. Similarly, other studies evaluating the effect of interactive nutrition lectures in different at-risk adult populations have also shown increases in measures of nutrition knowledge and behavior.[25,26]

Our findings indicate that optimal nutrition health promotion programs for Chinese Americans need to include both print and interactive educational methods. These results are consistent with published studies evaluating similar print or instructional interventions promoting healthy NPA in other Asian and non-Asian populations.[27,28] Future research could examine the training of the person delivering the oral information (e.g., a LHW, certified health educator, registered dietitian, or physician), the best education format (e.g., large lectures, small group sessions, or individual instruction), and the educational content (e.g., MyPlate recommendations, which do not focus on daily serving intake).

At preintervention, although almost none of the Chinese Americans in our study knew the recommended minimum level of physical activity, about 55% reported physical activity that met this recommended level; this baseline level is comparable to a study reporting that 51.6% of all US adults met this level.[29] Knowledge of the recommended level of physical activity increased by 2% in the group receiving Chinese-language print materials compared with a 19% increase in the group receiving the print materials and 2 lectures. Behaviors meeting the recommended level increased significantly by 10% with the print intervention; adding 2 Chinese-language lectures in the lectures plus print intervention led to a significant increase of 15%.

Unlike the findings for nutrition, we found no difference in effect on self-reported physical activity between the print and the lectures plus print interventions. This finding could be owing to a lack of power in the study to detect a small difference between the 2 interventions. A second possible explanation may be that teaching individuals about the benefits and the recommended level of physical activity may increase their level of physical activity to a small degree regardless of the mode of delivery, but greater increases may require other intervention methods in this population. Further research can explore the effect of alternative educational methods such as using LHWs who can provide social support and mobile technologies that can provide regular reminders and feedback.

Limitations and Strengths

This study had several important limitations. We used self-reported data, which may be subject to inflation because of a desire to meet perceived guidelines.[30,31] BMI may be underestimated because participants may have underreported their weight and overreported their height, a bias that may have varied by age and gender.[32] Furthermore, like other Asian Americans, Chinese Americans may have challenges in accurately estimating serving sizes of vegetables and fruits eaten because of their preference for "family-style" eating.[33] The findings from this sample of older Chinese Americans with LEP living in San Francisco may not be generalizable to other Chinese American groups or communities.

In addition, with changes in national dietary recommendations,[34,35] the nutrition guidelines we used are no longer the norm. Because we did not have a no-intervention control, the modest increases found in the print-only intervention may have been owing to increased exposure to the information through repeated surveys or to secular trends. The methodological strengths of this study include the RCT design with strong community engagement and a large sample size in an understudied population with a very high retention rate.

Public Health Implications

Both dietary behaviors and physical activity levels are critical, modifiable factors in the development and subsequent management of cardiovascular disease risk factors, such as hypertension and diabetes. In our study, two thirds of the participants reported having at least 1 cardiovascular disease risk factor (e.g., 15% had diabetes, and > 50% were overweight or obese). Asian Americans in particular are at risk because they tend to develop diabetes at lower BMIs.[8,9] Clearly, interventions are needed to address the potential morbidity and mortality resulting from poor nutrition and inadequate physical activity in this rapidly growing population.

In our cluster RCT, we found that in-language print materials led to modest increases in knowledge about nutrition and improvements in eating behavior and that adding lectures led to much larger effects. Print materials alone led to moderate increases

in the proportion of participants reporting adherence to the recommended physical activity level; adding lectures did not significantly increase adherence compared with print materials alone. These findings can help health promotion programs to design effective and relevant interventions for Chinese and other Asian American communities. AJPH

CONTRIBUTORS

J. Jih and G. Le led in writing the content. All authors contributed substantially to the conceptualization, design, analysis, and interpretation of data and participated in revising the content and approving the final version of the article.

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HUMAN PARTICIPANT PROTECTION

Study protocols were approved by the University of California, San Francisco and San Francisco State University institutional research boards.

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