

Lay Health Educators and Print Materials for the Promotion of Colorectal Cancer Screening Among Korean Americans: A Randomized Comparative Effectiveness Study

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BACKGROUND: Colorectal cancer (CRC) is the second most commonly diagnosed cancer among Korean American men and women. Although CRC screening is effective in reducing the burden of this disease, studies have shown that Korean Americans have low screening rates. **METHODS:** The authors conducted a 2-arm cluster randomized controlled trial comparing a brochure (print) with a brochure and lay health educator (LHE) outreach (print + LHE) in increasing CRC screening rates among Korean American individuals. Self-administered written surveys at baseline and at 6 months assessed knowledge of CRC and its screening, ever screening, and being up to date with screening. **RESULTS:** A total of 28 LHEs recruited 348 participants aged 50 to 75 years from their social networks. Significant percentages of participants reported not having health insurance (29.3%) or a usual source of care (35.6%). At 6 months postintervention, the print + LHE participants had a greater increase in knowledge compared with those in the print arm ($P = .0013$). In multivariable analyses, both groups had significant increases in ever screening (print plus LHE: odds ratio [OR], 1.60 [95% confidence interval (95% CI), 1.26-2.03] and print: OR, 1.42 [95% CI, 1.10-1.82]) and being up to date with screening (print plus LHE: OR, 1.63 [95% CI, 1.23-2.16] and print: OR, 1.40 [95% CI, 1.04-1.89]). However, these increases did not differ significantly between the study arms. Having insurance and having seen a provider within the past year were found to be positively associated with screening. **CONCLUSIONS:** Compared with a brochure, LHE outreach yielded greater increases in knowledge but resulted in similar increases in CRC screening in a Korean American population with barriers to health care access. More work is needed to appropriately address logistical and system barriers in this community. *Cancer* 2017;123:2705-15. © 2017 American Cancer Society.

KEYWORDS: Asian Americans, cancer screening, colorectal cancer, health education, lay health educators.

INTRODUCTION

From 2012 to 2015, the Asian American Network for Cancer Awareness, Research and Training (AANCART)¹ conducted randomized controlled trials (RCTs) studying the efficacy of lay health educators (LHEs) in promoting colorectal cancer (CRC) screening among 3 Asian American communities in 3 geographic locations: Koreans in Los Angeles, California; Hmong in Sacramento, California; and Filipinos in Oahu, Hawaii. The current study describes the work and findings of the Korean American RCT.

Numbering over 1.4 million in the 2010 US Census, Korean Americans are the fifth most populous group among Asian Americans.² They are relatively new to the United States, with nearly two-thirds (63%) having been born in Korea.³ The majority of Korean Americans aged ≥ 5 years (80%) speak Korean at home,⁴ with 53% of the Korean-born individuals reporting limited English proficiency.^{2,4}

CRC is the second most commonly diagnosed cancer among Korean American men and women,⁵ and the incidence is rising over time.^{5,6} Screening is an effective means of reducing the burden of this disease, and the US Preventive Services

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Task Force has endorsed several screening methods for individuals aged 50 to 75 years.⁷ However, studies have shown low screening use among Korean Americans,⁸⁻¹² and to our knowledge efforts including research focusing on CRC screening among Korean Americans are scant.¹³ An analysis of the California Health Interview Survey demonstrated that the rate of being up to date for CRC screening among Korean Americans increased from 30% in 2003 to 59.4% in 2009.¹² However, this remains well below the Healthy People 2020 goal of 70.5%.¹⁴

Interventions involving LHEs have been shown to be effective in increasing knowledge and promoting behavior changes among minority populations, including Asian Americans.¹⁵⁻²⁴ In particular, 3 recent RCTs have shown that LHE-led education was effective in increasing CRC screening among Vietnamese, Chinese, and Hmong Americans.^{19,20,22,23} However, although LHE-led education was a promising approach with a positive effect noted in a single-arm study with regard to increasing breast cancer screening among Korean Americans,²⁵ to the best of our knowledge there has been only 1 study to date regarding CRC with Korean Americans.²⁶ This study by Carney et al using community health workers was limited by not having CRC screening outcomes.²⁶ The purpose of the current study was to evaluate the effectiveness of LHEs in delivering information regarding CRC screening and increasing screening behavior among Korean Americans.

MATERIALS AND METHODS

Intervention Development

Development of the intervention program and materials was guided by the social cognitive theory^{27,28} and the transtheoretical model,²⁹ specifically addressing: 1) knowledge of CRC risk and prevention; 2) expectations regarding CRC screening (positive anticipatory outcomes of screening); 3) self-efficacy (confidence that one can obtain screening); and 4) intention (motivation and readiness to obtain screening). Materials included a flip chart and LHE training manual that were based on those developed and tested in previous studies among Chinese and Vietnamese Americans.^{19,20} The goal of the flip chart was to promote obtaining any CRC screening at the time interval recommended by the US Preventive Services Task Force during the study implementation period.⁷ Contents of the flip chart included description, risks, and symptoms of CRC; screening recommendations and barriers; and facilitators to screening with culturally appropriate messages.

Cultural Tailoring and Translation of Program Materials

The original program materials, which included survey instruments, a flip chart that LHEs could use to explain CRC and its screening, an LHE training manual, and nutrition and physical activity presentations originally were prepared for a similar project among Chinese Americans.^{20,22} The Korean study team revised and modified the English version of these materials in multiple iterations, based on recommendations made by community members in focus groups and interviews during the formative phase of the study (2011-2012). Focus group and interview participants were recruited from several local Korean churches and the Korean Resource Center (a community-based organization in Koreatown in Los Angeles that was established in 1983 with a mission to assist and empower minority communities in Southern California through service, education, culture, organizing, and coalition building).

Finalized materials were translated into Korean using double simultaneous forward translation.³⁰ Two bilingual study staff translated the materials independent of each other. The translations were compared and discrepancies were resolved by consensus. The translated materials subsequently were reviewed by additional focus groups and key informants including Korean community leaders such as church elders, pastors, and members of Korean American community-based organizations as well as members of the AANCART Outreach Program and Community Advisory Group for accuracy and for cultural appropriateness.

Study Design

The current study used a 2-arm, cluster randomized controlled design to assess the effect of a print intervention versus a print + LHE intervention on CRC screening at 6 months after the initiation of the intervention. The clustering was at the level of LHEs, which is appropriate because all LHEs recruited and retained their participants. Only the LHEs in the print + LHE arm delivered health education. LHEs recruited study participants from their social networks. Each LHE and his or her participants were randomly assigned to the print or the print + LHE arm.

The main study outcome was self-report of CRC screening at 6 months after initiation of the intervention. We estimated the number of participants per LHE based on our prior LHE studies.^{15,18} The study was powered to detect a net effect size of 0.20 between the 2 intervention arms in the percentage of participants ever screened for

CRC, assuming effect sizes of 0.25 in the print + LHE arm and 0.05 in the print arm, an LHE cluster size of 12 participants, an intracluster correlation coefficient of 0.05, and an attrition rate of 0.05. The Institutional Review Board at the University of California at San Francisco approved the human subjects protocols and materials used in the study.

Recruitment, Training, and Random Allocation of LHEs

Recruitment of the LHEs and study participants occurred over 3 time periods (waves). Each wave lasted approximately 10 to 12 months. LHEs were recruited using several methods: announcements, advertisements, and editorial articles in the Korean language media (*Korea Times* and *Korea Daily*); word of mouth by staff and LHEs who completed prior waves; and Korean language community announcement Web sites (www.missyusa.com and www.radiokorea.com). Eligibility criteria initially were for LHEs to be self-identified as Korean American, aged ≥ 35 years, fluent in Korean or English, and residing and planning to stay in the Los Angeles area for the next 12 months. Only 1 member of a household was allowed to participate as an LHE, and each LHE could participate in only 1 wave. After the first wave, the lower age limit was changed to 18 years to increase the pool of LHEs.

Once recruited, LHEs were randomized to either study arm and received orientation and training. LHEs in both arms received an identical 8-hour small-group orientation and training session but in separate groups to minimize contamination. At this point, neither the LHEs nor the trainer knew the randomization assignment. This orientation and training session included a description of the LHE program, a getting-to-know-each-other “ice breaker,” information concerning the study protocol, and roles and responsibilities including participant recruitment and protection of human subjects. Training also included an overview of research methods, including study design, the importance of randomization and avoiding contamination, the need for and nature of survey administration, the need and strategies for cohort maintenance, and the project timeline. Time was allotted for role plays for participant recruitment, questions, and feedback. Pretraining and posttraining surveys assessed LHEs’ knowledge and understanding.

After this session, LHEs recruited participants for “a study on healthy behaviors on CRC and nutrition.” Once they had recruited their participants, LHEs were notified of the study arm assignment. The LHEs in the print + LHE arm participated in a second training ses-

sion, which included information regarding CRC, CRC screening tests, the pros and cons of each test, and barriers and facilitators to obtaining the tests. LHEs also learned to use the flip chart to teach participants about CRC and CRC screening. Each LHE was paid \$1200 to reflect the value of their cultural expertise and the time involved in the research.

Recruitment of Study Participants

Each LHE was asked to recruit 12 to 15 study participants from his or her social network, including friends, church members, coworkers, previous classmates, and family members. Eligibility criteria included age 50 to 75 years, self-identified as Korean, able to speak Korean or English (whichever language their LHE spoke), living and intending to stay in the Los Angeles area for at least 12 months, and willingness to participate in a study regarding health behaviors involving nutrition or CRC screening. Exclusion criteria included having a personal history of CRC and having medical problems that may prevent them from attending 2 educational sessions. To minimize contamination, as with the LHEs, only 1 member of a household was allowed to participate in the study (as either an LHE or a participant). As appreciation for their time, participants were paid \$20 after completing the baseline survey and \$40 after completing the follow-up survey.

Print Intervention Activities

Along with their LHEs, participants in the print arm attended 2 lectures concerning nutrition and physical activity 2 months apart that were delivered by professional health educators. The lectures were given for attention control. These participants also received a CRC brochure (print) at the time of the first lecture. As part of cohort retention and also for attention control, participants in the print arm also received 2 follow-up telephone calls (1 call 1 month after each lecture) from their LHEs. During these telephone calls, the LHEs reminded their participants of the upcoming study activities and solicited questions they might have regarding nutrition and physical activity to be addressed by the professional health educators. The timing from the first lecture to the last telephone call was approximately 4 months.

Print + LHE Intervention Activities

Similarly, participants in the print + LHE arm attended 2 LHE-led educational sessions 2 months apart. They received the same brochure on CRC at the time of the first LHE-led educational session. The LHEs in this arm also made 2 follow-up telephone calls to each participant (1

call 1 month after each lecture) for both cohort retention and to deliver additional encouragement and information regarding CRC screening. The timing from the first LHE-led educational session to the last telephone call was approximately 4 months.

In the first LHE-led CRC education sessions in the print + LHE arm, the LHEs described CRC; its prevalence, symptoms, risk factors, screening, barriers to screening, and how to overcome these barriers; and how to communicate with providers about CRC screening. The second LHE-led CRC education session included a review of the contents of the first session. The LHE led a discussion concerning participants' experiences with CRC screening and recognized those who have been screened as role models. The group discussed barriers that still existed and ways to solve those barriers.

During the follow-up individual telephone calls, LHEs in the print + LHE arm reminded their participants of the goal of obtaining a CRC screening test, answered questions, addressed concerns, taught or reinforced knowledge, and addressed specific barriers.

Preintervention and Postintervention Surveys

Self-administered written surveys at baseline and at 6 months after initiation of the intervention assessed knowledge regarding CRC and CRC screening and report of being ever screened and being up to date with screening. Participants in the print arm answered the preintervention survey at the time of the first lecture whereas those in the print + LHE arm answered the survey at the time of the first LHE-led educational session. Approximately 2 months after the second follow-up telephone call and 6 months after the preintervention survey, participants met for the third and final time to complete a postintervention survey and subsequently participate in a debriefing session. Those who could not make this postintervention session completed their postintervention survey over the telephone.

Community-Based Participatory Research Considerations

A key consideration in community-based participatory research projects is to ensure that participants receive appropriate health education regardless of their study arm assignment. Because participants in the print + LHE group did not receive any lectures regarding nutrition and physical activity, we distributed print materials that had similar information. For those in the print group, who did receive both nutrition and physical activity lectures and CRC information through the brochure, after the

postintervention survey was completed, we conducted a short training session with the LHEs assigned to this arm regarding CRC prevention and left it up to them to decide whether to hold education sessions with their participants. Because no participant in the print arm would have received any LHE-led activity regarding CRC before the postintervention survey, this approach should have had no influence on the CRC outcomes in the current study.

Measures

Surveys were conducted immediately before and 6 months after the first session. Sociodemographic variables included age, sex, birthplace, years in the United States, education, employment, marital status, English language proficiency, and household income. Access was measured by participants reporting whether they had health insurance, a primary care physician, and a regular place of care, and whether they had seen a physician within the past year. Health status was measured by self-rated health (excellent, very good, good, fair, or poor) and whether a physician had told the participant that he or she had cancer. The primary outcome measure was self-reported receipt of any CRC screening test (ever had a fecal occult blood test [FOBT], sigmoidoscopy, or colonoscopy). Secondary outcomes included up to date screening (FOBT within 1 year, sigmoidoscopy within 5 years, or colonoscopy within 10 years), receipt of each specific test, intention to be screened, awareness of CRC and screening tests, and knowledge (ie, 1) heard of colon polyps, 2) recommended frequency of testing [FOBT yearly, sigmoidoscopy every 5 years, and colonoscopy every 10 years], and 3) recommended age at which to initiate screening [50 years]).

Statistical Analysis

To evaluate the balance between the study arms, we used generalized linear models to compare the print + LHE and print groups with respect to sociodemographic characteristics, health status, and health care access (Table 1). For each outcome, a linear model was used to test for differences between the study arms in the change in outcome from preintervention to postintervention (Table 2).³¹ We also created logistic regression models of ever receipt of CRC screening and up-to-date CRC screening as a function of group (print + LHE or print), time (preintervention or postintervention), and group-by-time interaction adjusted for sociodemographic characteristics, health status, and health care access (Table 3). All analyses used the generalized estimating equation approach of Zeger and Liang to account for clustering of participants by LHE.³²

TABLE 1. Sociodemographic and Health Characteristics of Participants by Study Group at Time of Enrollment (N = 348)

Characteristic	Total	Print N = 164	Print + LHE N = 184	P
Age, y				.667
Mean \pm SD	61.4 \pm 7.6	61.6 \pm 7.8	61.3 \pm 7.4	
50-64, %	64.7	62.8	66.3	
\geq 65, %	35.3	37.2	33.7	
Female, %	83.6	88.4	79.4	.074
Married, %	68.4	64.0	72.3	.267
Spoken English proficiency, %				.970
Fluent/well/so-so	42.8	42.7	42.9	
Poor/not at all	57.2	57.3	57.1	
Education, %				.652
<High school	12.9	10.4	15.2	
High school	27.3	29.3	25.5	
Some college	19.8	20.7	19.0	
\geq College	39.9	39.6	40.2	
Employment, %				.802
Unemployed	35.9	37.2	34.8	
Employed	40.5	37.8	42.9	
Retired	23.6	25.0	22.2	
Household income, %				.444
<\$20,000	35.1	38.4	32.1	
\geq \$20,000	54.6	51.8	57.1	
Do not know/missing data	10.3	9.8	10.9	
Health status, %				.582
Excellent/very good/good	50.6	52.4	48.9	
Fair/poor	49.4	47.6	51.1	
Has health insurance, %	70.7	70.1	71.2	.848
Has regular place for health care, %	64.4	62.8	65.8	.620
Has a primary care physician, %	67.0	68.9	65.2	.537
Saw a medical provider within last 12 mo, %	72.7	73.2	72.3	.837

Abbreviations: LHE, lay health educator; SD, standard deviation.

RESULTS

Number of LHEs and Trial Participants

A total of 28 Korean LHEs (aged 40-70 years; 86% of whom were women) were recruited (7 LHEs in wave 1, 7 LHEs in wave 2, and 14 LHEs in wave 3). The LHEs identified 435 potential participants (averaging 15-16 participants per LHE) from their social networks who then were assessed for eligibility. Of these, 87 (20%) refused to participate, and 348 subsequently were randomized with their LHEs to either study arm. Fourteen LHEs and 184 participants were randomly assigned to the print + LHE arm and 14 LHEs and 164 participants were randomly assigned to the print arm. Ten participants were lost to follow-up, rendering a completion rate of 97% (Fig. 1).

Baseline Characteristics of the Trial Participants

Characteristics of the study participants are presented in Table 1. Study participants mostly were women (83.6%) and married (68.4%), and with a mean age of 61.4 \pm 7.6 years. Greater than one-third of participants were employed (40.5%), with 35.9% being unemployed and 23.6% being retired. Nearly all the participants were born

in South Korea (99.4%), with 87.4% having lived in the United States for >10 years (mean length of residence of 22.6 years). Participants had low acculturation because 92% spoke only Korean at home and 57.2% reported speaking English "poorly" or "not at all." However, they were highly educated, with 87% having at least completed high school and 60% having attended college. Approximately 35.1% reported having an annual household income of <\$20,000.

Nearly one-third of participants (29.3%) reported not having health insurance, with 35.6% not having a usual source of care and 27.3% not having seen a health care provider within the past 12 months. Approximately one-half of participants (49.4%) rated their general health as "fair" or "poor." Two-thirds reported having a primary care provider (67%), and of these, 91.4% reported the ethnicity of their providers to be of Korean descent. Approximately two-thirds of participants reported speaking Korean with their providers (62.5%) and approximately one-third (34%) reported needing assistance with interpretation with their provider.

The current study sample is somewhat comparable to that of Koreans in the 2015 American Community

TABLE 2. CRC Knowledge, Behavior, and Intention Outcomes from Preintervention to Postintervention by Study Arm Assignment (N = 348)

	Print Group N=164			Print + LHE Group N=184			P for Preintervention- Postintervention Differences Between Groups
	Preintervention, %	Postintervention %	P	Preintervention, %	Postintervention, %	P	
Awareness							
Ever heard of CRC	75.6	92.1	<.0001	80.4	96.2	<.0001	.850
Ever heard of colorectal polyp	65.2	86.0	<.0001	65.2	93.5	<.0001	.133
Ever heard of FOBT	34.2	50.0	.003	41.9	82.6	<.0001	.0002
Ever heard of colonoscopy	76.2	86.6	.003	83.7	93.5	.006	.907
Ever heard of sigmoidoscopy	12.2	20.7	.010	12.0	63.6	<.0001	<.0001
Heard of any CRC screening test	78.7	87.8	.0129	87.0	96.7	.0004	.8897
Knowledge							
Screening starts at age 50 y	40.2	40.9	.898	44.0	41.9	.582	.653
FOBT should be performed every y	23.2	24.4	.727	25.5	47.8	<.0001	.0002
Sigmoidoscopy should be performed every 5 y	32.3	37.2	.391	34.8	58.7	<.0001	.015
Colonoscopy should be performed every 10 y	7.32	11.6	.097	10.3	29.4	.003	.033
Screening behavior							
Ever underwent FOBT	26.8	29.9	.4047	23.9	35.3	.0005	.0887
Up to date for FOBT	6.7	7.9	.5196	4.9	13.6	<.0001	.0062
Ever underwent sigmoidoscopy or colonoscopy	42.7	47.6	.0375	45.1	54.3	.0003	.2095
Up to date for sigmoidoscopy or colonoscopy	39.6	46.3	.0780	38.0	48.4	.0004	.4505
Ever had any CRC screening	48.8	57.3	.0020	53.8	64.1	.0003	.6511
Up to date for any CRC screening	41.5	50.0	.0130	41.3	53.8	<.0001	.3902
Intention to undergo screening (not up to date participants)							
Plan to undergo FOBT within next 6 mo	17.0	15.2	.7232	26.3	31.5	.3264	.3389
Plan to undergo sigmoidoscopy/colonoscopy within next 6 mo	18.2	14.8	.5513	24.6	29.5	.4603	.343
Plan to undergo any CRC screening within next 6 mo	25.0	23.2	.8224	36.1	49.4	.0953	.1844

Abbreviations: CRC, colorectal cancer; FOBT, fecal occult blood test; LHE, lay health educator.

TABLE 3. Multivariable Models for Intervention Effects and Other Significant Factors of CRC Screening Among Korean Americans in Los Angeles (N=338)

	Ever Undergone CRC Screening	Up to Date for CRC Screening
	Adjusted OR (95% CI) ^a	
Postintervention vs preintervention effect for print + LHE	1.60 (1.26-2.03)	1.63 (1.23-2.16)
Postintervention vs preintervention effect for print	1.42 (1.10-1.82)	1.40 (1.04-1.89)
Intervention effect for print + LHE vs print intervention	1.13 (0.80-1.60)	1.16 (0.77-1.75)
Age ≥ 65 y (reference age: < 65 y)	1.67 (1.01-2.75)	1.52 (0.83-2.78)
Male sex (reference: female)	0.91 (0.51-1.63)	1.52 (0.83-2.78)
Married (reference: other)	0.87 (0.60-1.25)	0.90 (0.60-1.34)
Education (reference: < high school)		
College	1.00 (0.56-1.80)	0.99 (0.53-1.83)
Some college	1.20 (0.57-2.54)	1.10 (0.51-2.37)
High school	1.00 (0.52-1.92)	1.06 (0.55-2.05)
Ability to speak English is poor/not at all (reference: fluent/well/so-so)	0.95 (0.63-1.43)	0.77 (0.50-1.19)
Employed (reference: unemployed)	0.97 (0.61-1.54)	1.05 (0.67-1.65)
Income (reference: < \$20,000/y)		
≥ \$20,000/y	0.90 (0.49-1.63)	0.97 (0.51-1.84)
Don't know	0.61 (0.30-1.24)	0.60 (0.27-1.33)
US resident for ≥ 10 y (reference: < 10 y)	0.85 (0.45-1.63)	0.98 (0.62-1.55)
Excellent/very good general health (reference: fair/poor)	1.07 (0.71-1.62)	1.13 (0.76-1.68)
Seen physician within past y (reference: no)	2.71 (1.58-4.64)	2.84 (1.11-5.03)
Have health insurance (reference: no or do not know)	1.84 (1.21-2.78)	1.82 (1.11-2.99)

Abbreviations: 95% CI, 95% confidence interval; CRC, colorectal cancer; LHE, lay health educator; OR, odds ratio.

Models used generalized estimating equations to account for clustering of participants by LHE and included 690 preintervention and postintervention observations.

^a Bold type indicates statistical significance.

Survey in terms of educational attainment (92.5% with an educational level of ≥ high school), place of birth (99.1% born outside of the United States), and spoken language (75.5% spoke a language other than English).³³

At baseline, a majority (78.2%) reported having heard of CRC, and fewer (65.2%) reported having heard of polyps. A majority of participants reported having heard of colonoscopy (80.2%), but only approximately one-third (38.2%) had heard of FOBT and even fewer (12.1%) had heard of flexible sigmoidoscopy. Only 22.4% of participants reported having received a recommendation for sigmoidoscopy or colonoscopy, and 11.5% reported having received a recommendation for FOBT from their health care provider.

Changes in Screening Knowledge, Behavior, and Intention

Table 2 compares CRC awareness and knowledge, screening behavior, and intention to undergo screening from the preintervention to postintervention periods by study arm assignment.

Changes in Screening Knowledge

Both study arms demonstrated significant increases in awareness of CRC and its screening, whereas knowledge of screening intervals for FOBT, sigmoidoscopy, and colonoscopy were noted to increase only in the print + LHE arm.

In comparing pretest and posttest changes between the print and the print + LHE arms, participants in the print + LHE arm had significantly greater increases in having heard of FOBT, having heard of sigmoidoscopy, and knowledge of the screening intervals for the 3 screening tests.

Changes in Screening Behavior

In the print group, there were significant increases in several of the screening outcomes: ever underwent sigmoidoscopy or colonoscopy (42.7% to 47.6%; $P = .0375$), ever receiving any CRC screening (48.8% to 57.3%; $P = .002$), and being up to date for screening (41.5% to 50.0%; $P = .013$). For the print + LHE group, there were significant increases in all screening outcomes: ever underwent FOBT (23.9% to 35.3%; $P = .0005$), ever underwent sigmoidoscopy or colonoscopy (45.1% to 54.3%; $P = .0003$), ever underwent any CRC screening (53.8% to 64.1%; $P = .0003$), and being up to date with screening (41.3% to 53.8%; $P < .0001$). In comparing pretest and posttest changes between the print and the print + LHE study arms, the only significant difference between the 2 arms was that participants in the print + LHE arm were more likely to be up to date for FOBT.

Changes in Intentions to Undergo Screening

For intentions to undergo screening among those participants who were not up to date with screening, there were no significant increases noted in either group.

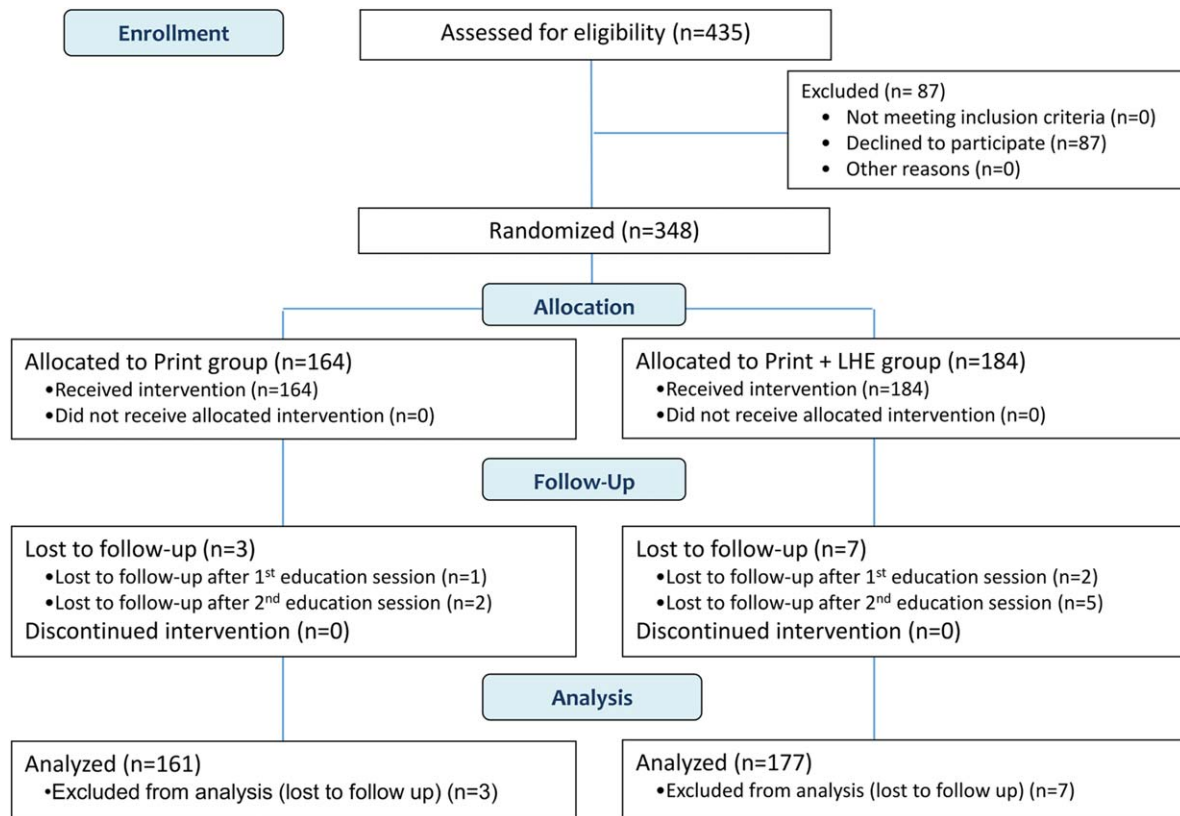


Figure 1. Consolidated Standards Of Reporting Trials (CONSORT) diagram. LHE indicates lay health educator.

Multivariable Regression Analyses on Screening Behavior

In multivariable regression analyses (Table 3), both study arms were found to have significant increases in 1) ever screening (print + LHE: adjusted odds ratio [AOR], 1.60 [95% confidence interval (95% CI), 1.26-2.03] and print: AOR, 1.42 [95% CI, 1.10-1.82]) and 2) being up to date with screening (print + LHE: AOR, 1.63 [95% CI, 1.23-2.16] and print: AOR, 1.40 [95% CI, 1.04-1.89]). There were no significant differences noted in the increase in CRC screening between the 2 arms. Having insurance and having seen a health care provider within the past year were found to be positively associated with being ever screened and being up to date with screening. Older age (≥ 65 years) was found to be positively associated with being ever screened.

DISCUSSION

The current study compared the effect of LHEs and a brochure on awareness and knowledge of CRC and CRC screening behavior among Korean American individuals. We were successful in working with the local Korean

American community to culturally tailor a program that was previously developed and tested in Chinese and Vietnamese American populations,^{19,20,22} and in implementing an RCT in this community. To our knowledge, the current study is one of the first RCTs to focus on CRC prevention among Korean Americans using LHEs and the first to assess CRC screening behaviors. We are aware of one other study, conducted by Carney et al, that tested the impact of trained community health workers on knowledge, attitudes, beliefs, and intentions regarding CRC screening among 3 Asian populations, including Korean Americans.²⁶

The results of the current study demonstrate that both the print and print + LHE interventions increased awareness and knowledge of CRC as well as CRC screening behavior. The print + LHE intervention was found to be superior to the brochure in increasing awareness and knowledge. This is in contrast to the study by Carney et al, which found that a community health worker intervention had little to no effect on Korean Americans' knowledge, attitudes, beliefs, and intentions regarding CRC screening.²⁶ That study did not assess CRC

screening behavior outcomes.²⁶ In the current study, adding LHE outreach did not appear to increase the impact of a brochure on CRC screening behavior.

The effect of the print intervention on screening exceeded our expectations. In the literature, small or no intervention effects for print materials generally have been reported in cancer screening trials among minority and underserved populations.³⁴⁻³⁶ One possible explanation is that the Korean American individuals in the current study sample were highly educated and may simply have needed to have the information regarding CRC available in their language to be convinced of the need to get screening. Another explanation may be that the print intervention condition may be influenced by the social network recruitment, leading to additional benefit from being in an LHE group and meeting together on multiple occasions even if it was not related to CRC education. Within tightly knit social groups/networks, small amounts of information may serve as stimuli for further discussion and action. Because participants in both study arms knew from the time of recruitment that they would learn about either CRC prevention or nutrition and physical activity, it is possible that CRC prevention was informally explored and discussed in the print group as well.

The finding that the print + LHE intervention was not more efficacious than the print intervention in increasing CRC screening was surprising, because studies among Chinese, Vietnamese, and Hmong populations did find an effect.^{19,20,22,23} Similarly, Carney et al also found that their intervention had some effect on the Chinese and Vietnamese subgroups, but no effect on the Korean American population despite receptiveness and satisfaction with the program.²⁶ A possible explanation is that the effects of LHE outreach are different for Korean Americans than for Chinese or Vietnamese Americans. It is likely that the LHEs in the current study, who only provided informational and social support but not logistical support nor assistance in addressing access barriers, may not be as effective in promoting CRC screening in populations with high access barriers (ie, lack of a usual source of care, lack of health insurance). This is supported by comments from LHEs and participants in debriefing focus groups stating that many preferred FOBT over endoscopic methods for simplicity and low cost, but that they were not successful in finding providers or clinics that offered FOBT. Moreover, in a prior qualitative study among Korean-speaking physicians in the Los Angeles Koreatown area, we found that Korean-speaking physicians were likely to believe that FOBT is not adequate as a screening method.³⁷ Participants at a community forum

that was held with former LHEs from the current study and other community leaders mentioned that many Korean-speaking providers in Los Angeles are private practitioners who may be dissuaded by low reimbursement rates for FOBTs. Another explanation is that the follow-up period of 6 months may not have been long enough for those with access barriers to coordinate the necessary steps for screening, such as finding a provider, making appointments (particularly with safety net or community-based clinics), and getting referrals for endoscopy and then completing endoscopy in systems with a limited number of endoscopists.

There are several limitations to the current study, including social desirability and recall biases that are inherent to self-reported data. Apart from a desire to appear compliant with the recommended screening tests, participants may have wanted to help their LHEs, who also are members of their social network, by exaggerating their report of test receipt. Regarding recall, although it is unlikely that one would forget the experience of undergoing a colonoscopy or performing an FOBT, not knowing the names of these tests would lead to inaccurate reporting. We tried to address this potential reporting error by describing each of the screening tests in detail in the pretest and posttest surveys. However, in doing so, exposure to information regarding CRC was likely increased in the print group. Validation of self-reports would have been useful, but was beyond the budgetary scope of this project. Another limitation is that the results of the current study may have been diluted by contamination because information can spread easily through established community and social networks such as churches, temples, and other faith communities, and the majority of the participants were recruited from these types of social networks. Moreover, the findings of the current study may not be generalizable to Korean American individuals living in other parts of the country, those who are more acculturated, or those who are recruited through other methods.

Because the LHE outreach did not demonstrate a significant additional benefit to the print material in this project, a question is raised as to whether LHE outreach is an appropriate strategy with which to address health issues among Korean Americans. We learned from the debriefing focus groups and the community forum that there were some benefits to LHE outreach. The LHEs wished to continue this work and asked to be contacted for future opportunities. The LHEs stated that they fulfilled a particular need in their community, but thought that their role and responsibilities could be expanded to include higher levels of support for the participants (eg,

facilitating distribution of FOBT kits to participants) to better meet the needs of the community. Study participants in the debriefing focus groups also concurred with the LHEs and stated that they found their time together with their LHEs beneficial, that they wanted to be contacted for future projects, and that they would recommend other family members and friends to similar programs. More work is needed to better understand barriers to screening and how they influence the effectiveness of community-based programs that use LHEs.

Conclusions

We were successful in working with the Korean American community in tailoring a culturally appropriate intervention involving LHEs and implementing this project in the community. The program was well received by the community. The results of the current study suggest that a print brochure was as effective as an educational program involving trained LHEs. The current study results were slightly different from those for Vietnamese and Chinese Americans in ways that suggest more work is needed, particularly with respect to identifying barriers to screening and how they may alter the effectiveness of community-based programs that use LHEs.

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The authors made no disclosures.

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Angela M. Jo: Conceptualization, methodology, project administration, investigation, formal analysis, and writing-original draft. **Tung T. Nguyen:** Conceptualization, methodology, formal analysis, writing-original draft, project administration, supervision, and funding acquisition. **Susan Stewart:** Conceptualization, methodology, software, validation, formal analysis, writing-original draft, supervision, and funding acquisition. **Min J. Sung:** Visualization, project administration, investigation, and writing-review and editing. **Ginny Gildengorin:** Conceptualization, methodology, software, validation, formal analysis, and writing-review and editing. **Janice Y. Tsoh:** Conceptualization, methodology, formal analysis, and writing-review and editing. **Elisa K. Tong:** Conceptualization, methodology, and writing-review and editing. **Penny Lo:** Conceptualization, methodology, and writing-review and editing. **Charlene Cuaresma:** Conceptualization, methodology, and writing-review and editing. **Angela Sy:** Conceptualization, methodology, and writing-review and editing. **Hy Lam:** Conceptualization, methodology, software, validation, resources, data curation, writing-

review and editing, and project administration. **Ching Wong:** Conceptualization, methodology, resources, writing-review and editing, and project administration. **Matthew Jeong:** Writing-review and editing. **Moon S. Chen Jr:** Writing-review and editing, supervision, and funding acquisition. **Marjorie Kagawa-Singer:** Conceptualization, methodology, project administration, investigation, formal analysis, writing-original draft, project administration, supervision, and funding acquisition.

REFERENCES

1. Asian American Network for Cancer Awareness, Research and Training. The National Center for Reducing Asian American Cancer Health Disparities. <http://www.aancart.org/>. Accessed August 10, 2016.
2. US Census Bureau. The Asian population: 2010. <https://www.census.gov/prod/cen2010/briefs/c2010br-11.pdf>. Accessed August 10, 2016.
3. Terrazas A, Batog C. Korean immigrants in the United States. <http://www.migrationpolicy.org/article/korean-immigrants-united-states-0>. Accessed August 10, 2016.
4. US Census Bureau. Language use in the United States: 2011. <https://www.census.gov/prod/2013pubs/acs-22.pdf>. Accessed August 10, 2016.
5. Gomez SL, Noone AM, Lichtensztajn DY, et al. Cancer incidence trends among Asian American populations in the United States, 1990-2008. *J Natl Cancer Inst.* 2013;105:1096-1110.
6. Miller BA, Chu KC, Hankey BF, Ries LA. Cancer incidence and mortality patterns among specific Asian and Pacific Islander populations in the U.S. *Cancer Causes Control.* 2007;19:227-256.
7. US Preventive Services Task Force. Screening for colorectal cancer: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med.* 2008;149:627-637.
8. Oh KM, Jacobsen KH. Colorectal cancer screening among Korean Americans: a systematic review. *J Community Health.* 2014;39:193-200.
9. Jo AM, Maxwell AE, Wong WK, Bastani R. Colorectal cancer screening among underserved Korean Americans in Los Angeles County. *J Immigr Minor Health.* 2007;10:119-126.
10. Hwang H. Colorectal cancer screening among Asian Americans. *Asian Pac J Cancer Prev.* 2013;14:4025-4032.
11. Lee HY, Lundquist M, Ju E, Luo X, Townsend A. Colorectal cancer screening disparities in Asian Americans and Pacific Islanders: which groups are most vulnerable? *Ethn Health.* 2011;16:501-518.
12. Fedewa SA, Sauer AG, Siegel RL, Smith RA, Torre LA, Jemal A. Temporal trends in colorectal cancer screening among Asian Americans. *Cancer Epidemiol Biomarkers Prev.* 2016;25:995-1000.
13. Hou SI, Sealy DA, Kabiru CW. Closing the disparity gap: cancer screening interventions among Asians—a systematic literature review. *Asian Pac J Cancer Prev.* 2011;12:3133-3139.
14. Office of Disease Prevention and Health Promotion. HealthyPeople.gov. Cancer. <https://www.healthypeople.gov/2020/topics-objectives/topic/cancer/objectives>. Accessed October 19, 2016.
15. Mock J, McPhee SJ, Nguyen T, et al. Effective lay health worker outreach and media-based education for promoting cervical cancer screening among Vietnamese American women. *Am J Public Health.* 2007;97:1693-1700.
16. Maxwell AE, Wang JH, Young L, et al. Pilot test of a peer-led small-group video intervention to promote mammography screening among Chinese American immigrants. *Health Promot Pract.* 2011;12:887-899.
17. Taylor VM, Jackson JC, Yasui Y, et al. Evaluation of a cervical cancer control intervention using lay health workers for Vietnamese American women. *Am J Public Health.* 2010;100:1924-1929.
18. Nguyen TT, Le G, Nguyen T, et al. Breast cancer screening among Vietnamese Americans: a randomized controlled trial of lay health worker outreach. *Am J Prev Med.* 2009;37:306-313.
19. Nguyen TT, Love MB, Liang C, et al. A pilot study of lay health worker outreach and colorectal cancer screening among Chinese Americans. *J Cancer Educ.* 2010;25:405-412.

20. Nguyen BH, Stewart SL, Nguyen TT, Bui-Tong N, McPhee SJ. Effectiveness of lay health worker outreach in reducing disparities in colorectal cancer screening in Vietnamese Americans. *Am J Public Health*. 2015;105:2083-2089.
21. Kim K, Choi JS, Choi E, et al. Effects of community-based health worker interventions to improve chronic disease management and care among vulnerable populations: a systematic review. *Am J Public Health*. 2016;106:e3-e28.
22. Nguyen TT, Tsoh J, Woo K, et al. Colorectal cancer screening and Chinese Americans: efficacy of lay health worker outreach and print materials [published online ahead of print December 1, 2016]. *Am J Prev Med*. doi: 10.1016/j.amepre.2016.10.003.
23. Tong EK, Nguyen TT, Lo P, et al. Lay health educators increase colorectal cancer screening among Hmong Americans: a cluster randomized controlled trial. *Cancer*. 2017;123:98-106.
24. Juon HS, Strong C, Kim F, Park E, Lee S. Lay health worker intervention improved compliance with hepatitis B vaccination in Asian Americans: randomized controlled trial. *PLoS One*. 2016;11:e0162683.
25. Han HR, Lee H, Kim MT, Kim KB. Tailored lay health worker intervention improves breast cancer screening outcomes in non-adherent Korean-American women. *Health Educ Res*. 2009;24:318-329.
26. Carney PA, Lee-Lin F, Mongoue-Tchokote S, et al. Improving colorectal cancer screening in Asian Americans: results of a randomized intervention study. *Cancer*. 2014;120:1702-1712.
27. Bandura A. Social cognitive theory: an agentic perspective. *Annu Rev Psychol*. 2001;52:1-26.
28. Bandura A. Social Foundations of Thought and Action: A Social Cognitive Theory. Upper Saddle River NJ: Prentice-Hall Inc; 1986.
29. Prochaska JO, Velicer WF. The transtheoretical model of health behavior change. *Am J Health Promot*. 1997;12:38-48.
30. Ponce NA, Lavarreda SA, Yen W, Brown ER, DiSogra C, Satter DE. The California Health Interview Survey 2001: translation of a major survey for California's multiethnic population. *Public Health Rep*. 2004;119:388-395.
31. Greenberg RS, Kleinbaum DG. Mathematical modeling strategies for the analysis of epidemiologic research. *Annu Rev Public Health*. 1985;6:223-245.
32. Zeger SL, Liang KY. Longitudinal data analysis for discrete and continuous outcomes. *Biometrics*. 1986;42:121-130.
33. US Census Bureau. American FactFinder-results. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_09_1YR_S0201&prodType=table. Accessed November 4, 2016.
34. Maxwell AE, Jo AM, Chin SY, Lee KS, Bastani R. Impact of a print intervention to increase annual mammography screening among Korean American women enrolled in the National Breast and Cervical Cancer Early Detection Program. *Cancer Detect Prev*. 2008;32:229-235.
35. Sung JF, Blumenthal DS, Coates RJ, Williams JE, Alema-Mensah E, Liff JM. Effect of a cancer screening intervention conducted by lay health workers among inner-city women. *Am J Prev Med*. 1997;13:51-57.
36. Lu M, Moritz S, Lorenzetti D, Sykes L, Straus S, Quan H. A systematic review of interventions to increase breast and cervical cancer screening uptake among Asian women. *BMC Public Health*. 2012;12:413.
37. Jo AM, Maxwell AE, Rick AJ, Cha J, Bastani R. Why are Korean American physicians reluctant to recommend colorectal cancer screening to Korean American patients. Exploratory interview findings. *J Immigr Minor Health*. 2008;11:302-309.