



# Community-Based Cervical Cancer Education: Changes in Knowledge and Beliefs Among Vietnamese American Women

Carolyn Y. Fang<sup>1</sup> · Minsun Lee<sup>2</sup> · Ziding Feng<sup>3</sup> · Yin Tan<sup>2</sup> · Fayola Levine<sup>4</sup> · Cuc Nguyen<sup>5</sup> · Grace X. Ma<sup>6</sup>

Published online: 26 March 2019

© Springer Science+Business Media, LLC, part of Springer Nature 2019

## Abstract

Low cervical cancer screening rates among Vietnamese American women have been attributed, in part, to inadequate knowledge about cervical cancer and health beliefs that hinder screening. A community-based educational program was developed to improve knowledge and attitudes toward cervical cancer screening in this underserved population. It was hypothesized that the program would result in increases in knowledge, as well as enhanced health beliefs and self-efficacy toward obtaining cervical cancer screening. Using a group-randomized design, 1488 women from 30 Vietnamese community-based organizations were assigned to either the intervention ( $n = 816$ ) or control ( $n = 672$ ) conditions. The intervention group received cervical cancer education delivered by bilingual community health educators. Intervention content addressed individual beliefs and expectancies regarding cervical cancer screening (e.g., perceived risk of developing cervical cancer; perceived benefits and barriers to screening; social and cultural norms regarding screening). The control group received general health education, including information about cancer screening. Knowledge and health beliefs were assessed at baseline and post-intervention. Among women in the intervention group, overall knowledge about cervical cancer and screening guidelines increased from pre- to post-program (30% vs. 88%,  $p < 0.001$ ), perceived benefits of screening increased (3.50 vs. 4.49,  $p < 0.001$ ), and perceived barriers to screening decreased (3.13 vs. 2.25,  $p < 0.001$ ). Changes in knowledge and health beliefs were not observed among women in the control group. A community-based educational program can help increase knowledge about cervical cancer and screening, promote positive changes in women's beliefs about the benefits of cervical cancer screening, and reduce perceived barriers to screening. Such programs may play an important role in addressing health disparities and informing underserved populations about recommended screening tests.

**Keywords** Cervical cancer · Health beliefs · Knowledge · Vietnamese American women

## Introduction

Although significant advances in cervical cancer early detection and prevention have reduced the incidence, prevalence and mortality rates of this disease among U.S. women, incidence and mortality rates remain high in certain population subgroups [1, 2]. Disparities in cervical cancer incidence rates have been attributed, in part, to differences in screening uptake. Specifically, cervical cancer screening rates are dramatically lower among Vietnamese American women compared to women in other ethnic and racial subgroups [3]. Vietnamese American women also report lower levels of knowledge about cervical cancer screening and misperceptions about cancer and screening, which are associated with low screening uptake [4, 5]. Educational programs to increase knowledge and promote positive attitudes toward screening have been developed and evaluated in other

✉ Carolyn Y. Fang  
carolyn.fang@fcc.edu

<sup>1</sup> Cancer Prevention and Control Program, Fox Chase Cancer Center, 333 Cottman Ave, Philadelphia, PA 19111, USA

<sup>2</sup> Center for Asian Health, Lewis Katz School of Medicine, Temple University, Philadelphia, PA, USA

<sup>3</sup> Biostatistics Program, The Fred Hutchinson Cancer Research Center, Seattle, WA, USA

<sup>4</sup> Hunter College, New York, NY, USA

<sup>5</sup> Asian Community Health Coalition, Philadelphia, PA, USA

<sup>6</sup> Department of Clinical Sciences, Center for Asian Health, Lewis Katz School of Medicine, Temple University, Philadelphia, PA, USA

populations [6], but few evidence-based programs exist for Vietnamese American women.

Our pilot work conducted with Vietnamese American women indicated that overall levels of knowledge about cervical cancer and screening are low [7]. In addition, women's perceived risk, benefits of screening, and barriers to screening were associated with screening behavior [8]. Therefore, we developed a community-based program designed to improve knowledge and attitudes toward cervical cancer screening in this at-risk population [9]. Development of the educational content was guided by a conceptual framework derived from the Health Belief Model (HBM) [10] and Social Cognitive Theory (SCT) [11]. The intervention addressed women's knowledge and awareness of cervical cancer and its risk factors, health beliefs about cervical cancer and screening (perceived risk, perceived severity of cervical cancer, perceived benefits of and barriers to screening), and self-efficacy in obtaining screening. It was hypothesized that the program would result in increases in knowledge, and enhanced health beliefs and self-efficacy toward cervical cancer screening.

## Methods

### Study Sites and Participants

The Center for Asian Health (CAH) has an enduring collaborative relationship with more than 380 Asian American community-based organizations represented by the Asian Community Health Coalition (ACHC), a nonprofit 501(c)(3) umbrella organization, established concurrently with CAH in 2000. The Vietnamese community-based organizations (VCOs) included in this study serve important social functions and they represent the ideal milieu for disseminating information on accessibility to needed health services. Their unique status in these communities underscores their importance as an ideal venue for program delivery. The range of female Vietnamese American members in the 30 organizations included in this study is between 80 and 2500. The average age of members is 52 years and ranged from 20 to 70 years. Vietnamese American community leaders were directly involved in the planning, development, and implementation of the project.

From 2008 to 2011, Vietnamese American women ( $n = 1949$ ) were recruited from 30 participating VCOs and assessed for study eligibility. The 30 community organizations were matched into 15 pairs and randomized within each pair to either the intervention or control group as previously described [9]. Women were recruited in person, using informational fliers and community organization leadership engagement. Of the total who were assessed for eligibility, 1518 women met the inclusion criteria of self-identified

Vietnamese identity; aged 18–70 years; was not currently up-to-date with recommended cervical cancer screening guidelines; and had not been diagnosed with cervical cancer. Among eligible women, 1488 consented, completed the baseline assessment, and are included in the data analysis for this article. Overall, 816 women participated in the intervention program and 672 women participated in the control group. This study was approved by the Temple University Institutional Review Board and the Fox Chase Cancer Center Institutional Review Board.

### Procedures

Prior to project implementation, community leaders and volunteers participated in training sessions focused on re-visitation of project aims and their significance to Vietnamese women, recruitment strategies, and guidelines for administration of the study assessments and program delivery. All measures in English were translated, back-translated and pretested in Vietnamese to ensure the scientific and cultural appropriateness of the instrument for community Vietnamese participants. The 20- to 30-min baseline survey was offered in both Vietnamese and English language versions, and bilingual assistance was available at all sites. All study participants completed the survey in Vietnamese.

At study entry, participants completed baseline assessments of knowledge, health beliefs, and self-efficacy. Intervention participants met in small groups and received one 2-h educational session conducted by bilingual community health educators (CHEs). Educational sessions were held at community sites and focused on cervical cancer risk in the general population and specifically among Vietnamese American women; screening guidelines and procedures; and strategies for overcoming barriers to screening relevant to Vietnamese American women. The content of the culturally-relevant educational program, which was guided by the Health Belief Model (HBM) [12] and Social Cognitive Theory (SCT) [13–15], addressed individual beliefs and expectancies regarding cervical cancer screening (e.g., perceived risk of developing cervical cancer; perceived benefits and barriers to screening; and social and cultural norms regarding screening). Materials on cervical cancer screening from federal agencies (NCI) were translated and distributed to participants. Information and resources on obtaining low-cost or free screening was provided, and intervention materials were available in both Vietnamese and English language versions.

Participants in the control condition also received a 2-h education session delivered by bilingual CHEs. This session included topics on general health, including healthy lifestyle behaviors and the benefits of obtaining routine medical checkups and cancer screening. Health promotion materials

available from federal agencies were translated and made available in both English and Vietnamese language.

Following the educational sessions, participants completed post-program assessments of knowledge, health beliefs, and self-efficacy.

## Measures

The measures collected at baseline assessment include: (1) demographic characteristics and acculturation level; (2) Pap test history (i.e. ever had a prior Pap test); (3) knowledge of cervical cancer and screening; and (4) perceptions related to Health Belief Model and Social Cognitive Theory constructs. Information regarding the association of demographic and acculturation variables and beliefs about cervical cancer screening with prior Pap test screening behavior have been reported elsewhere [8].

### Demographics and acculturation

Demographic variables (e.g., age, education, and employment status) and acculturation level (e.g., English speaking/reading ability, country of birth, length of time living in the United States) were assessed to characterize the study sample.

### Knowledge

Nine items were used to assess women's knowledge regarding cervical cancer and the Pap test [7]. Response options for each item were "Yes", "No", or "Do not know." These items were utilized in a number of our previous studies [7, 16–18].

### HBM Constructs

Items assessing HBM constructs were adapted from Champion for use with this population [19]. Internal consistency, test–retest reliability, construct validity and predictive validity of the HBM subscales have been reported in our prior work [8]. Responses to each item were scored on a five-point Likert-type scale ranging from 1 ("Strongly disagree") to 5 ("Strongly agree"). *Perceived susceptibility* of developing cervical cancer was assessed using two items: "I think I am at risk for getting cervical cancer" and "I am more likely than the average woman to get cervical cancer." *Perceived severity* of the disease was assessed using three items (e.g., "Most women who develop cervical cancer will die from it"). In the present sample, Cronbach's alpha coefficient was 0.74 for perceived severity. *Perceived benefits* of undergoing cervical cancer screening were assessed using five items (e.g., "A Pap test can detect cervical cancer in its early stages, when it is easier to treat and cure"). Cronbach's alpha coefficient was 0.97

for perceived benefits, indicating high internal consistency. *Perceived psychosocial and structural barriers* to screening were assessed using 14 items (e.g., "I am scared to have a Pap test because I might learn that I have cancer"; "I have language difficulties that make scheduling a Pap test very hard"). Cronbach's alpha coefficient was 0.88 for perceived barriers. *Self-efficacy* in obtaining screening was assessed using three items (e.g., "I feel capable of arranging to have a Pap test"). Responses to each item were scored on a 10 point scale ranging from 1 (not at all confident) to 10 (totally confident). Cronbach's alpha coefficient was 0.99 for self-efficacy.

## Data Analysis

To compare sample characteristics between the intervention and control groups, Chi square tests were performed. Any demographic variables that significantly differed between the two groups were included as covariates in subsequent analyses. For descriptive purposes, the proportion of women who responded in a particular fashion ("Yes" to each knowledge item; "Agree" or "Strongly agree" to each health belief) was calculated by site. Then, matched-pair T-tests were conducted to examine whether the proportion of participants who endorsed each item significantly changed from pre- to post-program in each (intervention and control) group.

To investigate the effect of the intervention on psychosocial beliefs, each variable was scored as follows. Knowledge variables were coded as '1' for each correct answer and '0' for each incorrect or "Do not know" response, and then the mean score across all knowledge items were calculated. For the variables of perceived susceptibility, severity, benefit, and barriers, mean scores were calculated by adding up each item response (ranging from 1 to 5, where higher scores represent greater agreement with that belief) and dividing the total scores by number of items for each variable. The mean score of the self-efficacy items, which were measured on a 10-point scale, was also calculated. For all psychosocial variables, a higher numeric value indicated a higher level of that psychosocial construct. To compute change scores, the baseline scores were subtracted from the post-program scores. Thus, positive scores reflect an increase in the psychosocial construct at post-program.

Match-paired T-tests were conducted to examine whether the scores of each psychosocial construct significantly changed from pre- to post-program within each group (intervention and control group separately). Then, analysis of covariance (ANCOVA) was conducted to determine whether the extent of change observed was significantly different across the intervention and the control groups.

## Results

### Participant Characteristics

Participants were predominantly married (74.9%) and had a high school education (60.2%) or below (32.8%). The majority of participants (86.8%) reported an annual household income of ≤\$20,000. More than 94% of study participants were foreign-born, and although many had resided in the US between 11 and 20 years, very few participants reported proficiency in reading or speaking English (see Table 1).

There were no significant differences between the intervention and control groups on age, marital status, employment status, number of years residing in the US, or English language proficiency. However, there were significant differences in education level ( $p < 0.001$ ), household income ( $p = 0.003$ ), and country of birth ( $p < 0.001$ ) (see Table 1). Specifically, a greater proportion of intervention participants were foreign-born and had received a high school education or beyond, but were more likely to report a lower household income (≤\$20,000) compared to the control group.

**Table 1** Demographic characteristics at baseline

	Total N = 1488 (%)	Intervention N = 816 (%)	Control N = 672 (%)	p-value
Age	1478	812	666	.109
≤ 29	142 (9.6%)	85 (10.5%)	57 (8.6%)	
30–49	555 (37.5%)	302 (37.1%)	253 (38.0%)	
50–64	561 (38.0%)	292 (36.0%)	269 (40.3%)	
≥ 65	220 (14.9%)	133 (16.4%)	87 (13.1%)	
Marital status	1479	809	670	0.449
Married/living as married	1108 (74.9%)	611 (75.4%)	497 (74.2%)	
Never married	197 (13.3%)	103 (12.8%)	94 (14.0%)	
Divorced/separated	68 (4.6%)	42 (5.3%)	26 (3.9%)	
Widowed	106 (7.2%)	53 (6.5%)	53 (7.9%)	
Education	1422	770	652	<0.001
Below high school	466 (32.8%)	216 (28.1%)	250 (38.4%)	
High school	857 (60.2%)	506 (65.7%)	351 (53.8%)	
College or above	99 (7.0%)	48 (6.2%)	51 (7.8%)	
Employment status	1477	810	667	0.088
Employed	910 (61.6%)	514 (63.5%)	396 (59.4%)	
Unemployed	90 (6.1%)	55 (6.7%)	35 (5.2%)	
Retired	73 (4.9%)	34 (4.2%)	39 (5.8%)	
Homemaker/student	404 (27.4%)	207 (25.6%)	197 (29.6%)	
Household income	882	430	452	0.003
≤ \$20,000	776 (86.8%)	390 (90.7%)	376 (83.2%)	
\$20,000–\$40,000	100 (11.4%)	36 (8.4%)	64 (14.2%)	
\$40,000+	16 (1.8%)	4 (0.9%)	12 (2.6%)	
Nativity status	1475	810	665	<0.001
US born	85 (5.8%)	5 (0.6%)	80 (12.0%)	
Foreign born	1390 (94.2%)	805 (99.4%)	585 (88.0%)	
Years lived in the US	1453	799	654	0.266
≤ 10 years	482 (33.2%)	254 (31.8%)	228 (34.8%)	
11–20 years	875 (60.2%)	496 (62.1%)	379 (58.0%)	
> 20 years	96 (6.6%)	49 (6.1%)	47 (7.2%)	
English speaking proficiency	1484	814	670	0.083
Not at all/not well	1387 (93.5%)	769 (94.5%)	618 (92.2%)	
Well/very well	97 (6.5%)	45 (5.5%)	52 (7.8%)	
English reading proficiency	1480	815	665	0.510
Not at all/not well	1406 (95.0%)	777 (95.3%)	629 (94.6%)	
Well/very well	74 (5.0%)	38 (4.7%)	36 (5.4%)	

## Pre- and Post-education Knowledge, Attitudes, and Beliefs

Overall, levels of knowledge were generally low at baseline. However, in the intervention group, significant increases in the proportion of women who were knowledgeable about screening guidelines (e.g., who should undergo screening) and cervical cancer risk factors were observed at post-program compared to baseline (Table 2). Despite the improvements in knowledge, relatively fewer women were aware that one can have cervical cancer but not have any symptoms (61.4% at post-program) or that a Pap test is necessary for women who are not sexually active (64.1%) compared to all other knowledge items (> 90%) among women in the intervention group. The control group showed no significant changes in knowledge from pre- to post-program (Table 2).

Although perceived risk remains low in this population, a significant increase was observed in the proportion of women in the intervention group who agreed that they were at risk for cervical cancer (Table 2). For perceived severity, women in the intervention group were less likely to agree with the statement that “Most women who develop cervical will die from it” at post-program, perhaps reflecting the knowledge gained that cervical cancer is curable if detected early. However, at post-program, the majority of women in the intervention group (> 60%) agreed that cervical cancer would have a significant impact on their lives and relationships. In contrast, no changes in perceived risk or severity were observed among women in the control group (Table 2).

Women in the intervention group reported significant increases in the perceived benefits of screening. At post-program, nearly all intervention participants agreed that a Pap test can detect cervical cancer in its early stages, is important for staying healthy, is the best way to detect cervical cancer, and would reduce mortality from cervical cancer and one’s worry about cervical cancer (Table 2). Among control group participants, no significant changes in perceived benefits were reported.

Importantly, many perceived barriers to screening were reduced among women in the intervention group. From pre- to post-program, dramatic reductions were observed in the proportion of women who believed that receiving a Pap test costs too much money (from 61.3 to 10.0%), will take too much time (from 54.8 to 7.9%), or that a Pap test is not necessary if one feels OK (from 41.7 to 4.1%). The only perceived barrier that was not significantly impacted by the intervention program was the fear of learning that one might have cancer ( $p=0.335$ ). Among women in the control group, significant decreases in selected barriers were reported, namely around discomfort with screening being performed by a stranger (from 58.7 to 49.7%) or a male physician (51.0 to 43.2%), or with regard to access barriers such

as time, language difficulties, cost, lack of transportation, or physician availability (all  $p$ -values < 0.05).

Finally, increases in self-efficacy were observed from pre- to post-program (Table 2). Across both groups, women reported feeling more capable of making arrangements to have a Pap test and getting tested (both  $p$ -values < 0.05) at post-program. However, only women in the intervention group reported significant increases in their ability to manage any distress associated with obtaining a Pap test ( $p < 0.001$ ).

## Changes in Mean Knowledge, Attitudes, and Beliefs Over Time by Group

Items were combined to form each construct and evaluated for change over time by group (see Table 3). Significantly greater increases in knowledge from pre- to post-program were observed among the intervention group compared to the control group (time x group  $p$ -value < 0.001). Similarly, participants in the intervention group had significantly greater increases in perceived benefits of screening compared to the control group (time x group  $p$ -values < 0.001). Significantly greater decreases in perceived barriers were reported over time in the intervention group compared to the control group (time x group  $p$ -value = 0.002). Self-efficacy increased over time in both groups, but the increase was significantly greater in the intervention group compared to the control group (time x group  $p$ -value = 0.003).

## Discussion

We found that a community-based educational program can increase knowledge and attitudes about cervical cancer and screening among underserved Vietnamese American women. Guided by the Health Belief Model and Social Cognitive Theory, the program sought to increase knowledge and address women’s perceptions of risk, disease threat, and likely barriers to screening. The program also emphasized the benefits of cervical cancer screening and promoted positive social norms about screening and preventive health behaviors.

Our findings indicate that knowledge about cervical cancer risk factors and screening guidelines increased among women in the intervention condition, but not in the control condition. However, despite significant improvements in overall knowledge, more than one-third of women in the intervention group remain unaware that cervical cancer can be asymptomatic or that cervical cancer screening remains necessary among women who are not sexually active. Therefore, future community-based educational programs need to address these knowledge gaps and increase women’s awareness that early stage cervical cancer often has no symptoms.

**Table 2** Knowledge, attitudes, and beliefs at baseline and post-program

	Intervention (n = 816)			Control (n = 672)		
	Baseline	Follow-up	p-value	Baseline	Follow-up	p-value
<b>Knowledge (% yes)</b>						
One can have cervical cancer but not have symptoms	33.2%	61.4%	0.013	37.8%	39.8%	0.282
Cervical cancer can be cured if detected early	38.2%	95.8%	<0.001	53.6%	56.6%	0.249
Women 21 or older should have regular Pap tests	29.7%	96.2%	<0.001	42.5%	45.3%	0.062
Pap test is necessary for women who are not sexually active	21.9%	64.1%	<0.001	27.5%	31.5%	0.122
Women under 21 but sexually active for 3 years need Pap test	22.8%	94.1%	<0.001	27.1%	31.3%	0.182
Pap test is necessary for women who no longer menstruate	26.9%	95.2%	<0.001	37.2%	36.4%	0.797
Cervical cancer affects women of all ages	34.4%	94.6%	<0.001	56.6%	57.4%	0.560
Pap test can detect cancer early and prolong life	35.3%	97.2%	<0.001	54.2%	54.3%	0.912
Cervical cancer risk increases with age	25.8%	92.8%	<0.001	39.0%	38.8%	0.756
<b>Perceived risk (% agree)</b>						
I think I am at risk for getting cervical cancer	3.4%	13.8%	0.036	3.9%	3.5%	0.843
I am more likely than the average woman to get cervical cancer	2.5%	5.4%	0.168	2.7%	3.6%	0.491
<b>Perceived severity (% agree)</b>						
Most women who develop cervical cancer will die from it	41.5%	21.3%	0.053	28.5%	28.8%	0.946
My whole life would change if I had cervical cancer	46.1%	60.1%	0.166	44.5%	42.4%	0.483
Cervical cancer would threaten my relationship with my husband/partner	46.0%	57.6%	0.295	42.8%	39.4%	0.244
<b>Perceived benefits (% agree)</b>						
A Pap test can detect cervical cancer in its early stages when it is easier to treat and cure	40.1%	96.8%	<0.001	57.5%	56.1%	0.559
Getting a Pap test every year is an important thing for me to do in order to stay as healthy as I can	39.7%	98.3%	<0.001	57.9%	55.5%	0.436
Getting a Pap test is the best way to detect cervical cancer	37.8%	97.9%	<0.001	56.5%	55.7%	0.813
Having a Pap test every year will decrease my chances of dying from cervical cancer	36.6%	98.2%	<0.001	50.6%	50.9%	0.944
When I get a Pap test, I don't worry as much about cervical cancer	35.7%	96.4%	<0.001	48.1%	46.3%	0.580
<b>Perceived barriers (% agree)</b>						
Having a Pap test is embarrassing for me	15.1%	7.1%	0.003	13.8%	14.8%	0.568
I am scared to have a Pap test because I might learn that I have cancer	5.8%	4.5%	0.335	7.5%	6.8%	0.562
If I am destined to get cervical cancer, Pap test will not prevent it	14.5%	3.3%	0.009	14.9%	13.2%	0.383
I do not need a Pap test if I feel OK	41.7%	4.1%	<0.001	34.7%	26.6%	<0.001
Having a Pap test will be painful and unpleasant	26.3%	4.9%	0.002	31.8%	27.4%	0.070
Do not know where to go or who to ask to get a Pap test	26.3%	8.8%	0.001	30.7%	28.5%	0.097
Do not understand what will be done during a Pap test	24.6%	5.7%	0.001	29.7%	26.8%	0.165
Uncomfortable with having a stranger perform a Pap test	29.1%	9.6%	0.001	58.7%	49.7%	0.002
My partner is uncomfortable with me being examined by a male doctor	34.2%	9.9%	0.002	51.0%	43.2%	0.001
Having a Pap test takes too much time	54.8%	7.9%	<0.001	66.3%	58.2%	0.009
Language difficulties make it hard to schedule a Pap test	58.9%	15.8%	<0.001	54.3%	46.9%	0.010
Having a Pap test costs too much money	61.3%	10.0%	<0.001	65.5%	56.9%	0.004
I have no transportation to the clinic to get a Pap test	27.0%	10.9%	<0.001	28.2%	23.7%	0.041
Doctor is not available at convenient times for me to have a Pap test	33.9%	8.7%	0.003	26.1%	20.6%	0.017
<b>Self-efficacy [mean (SD) on a scale from 1 to 10]</b>						
Confident that I can make Pap test arrangements	6.66 (2.23)	9.05 (0.36)	0.001	7.17 (1.54)	7.38 (1.66)	0.015
Confident that I can get the Pap test	6.66 (2.24)	9.07 (0.34)	0.001	7.19 (1.56)	7.38 (1.66)	0.020
Confident that I can manage distress associated with getting a Pap test	6.55 (2.27)	8.92 (0.38)	0.001	7.18 (1.55)	7.29 (1.59)	0.085

**Table 3** Change in knowledge and health beliefs across groups over time

Construct	Intervention group Mean (SE)			Control group Mean (SE)			F	Time × group p-value <sup>b</sup>
	Pre	Post	p-value <sup>a</sup>	Pre	Post	p-value <sup>a</sup>		
Knowledge	0.30 (0.07)	0.88 (0.02)	<0.001	0.41 (0.07)	0.43 (0.07)	0.229	50.06	<0.001
Perceived Susceptibility	2.56 (0.05)	2.66 (0.08)	0.317	2.40 (0.08)	2.45 (0.07)	0.187	1.05	0.314
Perceived Severity	3.36 (0.10)	3.60 (0.12)	0.054	3.30 (0.08)	3.34 (0.08)	0.557	2.17	0.153
Perceived Barriers	3.13 (0.09)	2.25 (0.06)	<0.001	3.15 (0.09)	3.49 (0.40)	0.410	12.39	0.002
Perceived Benefits	3.50 (0.17)	4.49 (0.06)	<0.001	3.59 (0.17)	3.66 (0.17)	0.129	18.26	<0.001
Self-Efficacy	6.63 (0.58)	9.01 (0.09)	0.001	7.17 (0.39)	7.36 (0.42)	0.020	11.02	0.003

Analyses controlled for education, household income, and nativity

<sup>a</sup>The p-value indicates if the change of a certain measure from pre- to post-intervention is significant within one group (intervention or control)

<sup>b</sup>The p-value indicates if the change of a certain measure from pre- to post-intervention is significantly different between intervention and control group

Further, in reviewing screening guidelines and recommendations, educational programs should re-iterate the importance of undergoing cervical cancer screening regardless of whether one is currently sexually active. By adding these components, future programs may be more successful in addressing these key misperceptions.

Women's perceived susceptibility to cervical cancer did not increase following the program and remained relatively low, consistent with prior studies in which Asian American women report low perceived risk for cervical cancer [20]. However, perceived benefits of screening and early detection increased dramatically among women receiving the educational intervention. Women were more likely to believe that undergoing screening could lead to early detection, promote health, and reduce worry about cervical cancer. This shift toward more positive perceptions may help promote preventive health care practices [8, 21].

Similarly, women's perceived barriers to screening were reduced following participation in the educational program. Key concerns that a Pap test will be painful or embarrassing were reduced post-education, which is important given prior studies that found these concerns to be common among Asian women and negatively affect their participation in cervical cancer screening [22, 23]. The program also resulted in substantial reductions in perceived access and healthcare system barriers, although over 15% of women in the intervention group continued to report language barriers and nearly 11% indicated that lack of transportation to the clinic was a barrier to obtaining a Pap test. These findings indicate that we need to find ways to make screening exams more readily accessible within the community and to increase awareness of available medical translation services at healthcare clinics. Federal and state laws require that healthcare organizations that receive Medicare, Medicaid, or other federal funds must provide oral interpreters and written translated materials. Thus, increasing awareness

of these beneficial public health policies can help reduce perceived access barriers that may be impeding uptake of screening behavior.

Self-efficacy increased across both groups, although the change was more pronounced in the intervention group. Due to the complexity of actually obtaining screening (e.g., identifying a provider, scheduling an exam, completing medical and/or insurance paperwork, obtaining transportation to and from the clinic), other researchers have noted that it may be important to educate other members of the family, community members, and providers who serve this population, in order to support women's efforts to obtain necessary screening exams [24].

Several limitations of this study should be noted. First, participants were recruited from Vietnamese community organizations, which could limit generalizability to those individuals who do not belong to or participate in such organizations. Second, in order to not overburden participants with lengthy questionnaires, the study did not capture information on interpersonal factors [25] or other variables that may inform attitudes and beliefs toward cervical cancer screening. Due to the study framework, assessments were focused on constructs from the HBM and SCT. Finally, we acknowledge that changes in knowledge and beliefs may not necessarily translate into screening uptake. However, a recent systematic review reported that theory-based educational interventions are effective in promoting greater awareness of screening and increasing screening rates [6].

In summary, our findings indicate that a community-based educational program that acknowledges Vietnamese American women's cultural and social norms while encouraging them to adopt new health preventive concepts into their daily life can be effective in improving knowledge and promoting positive perceptions of cervical cancer screening. While healthcare access barriers remain a considerable obstacle, the provision of culturally-relevant information to

increase women's understanding of the importance of early detection can motivate and equip Vietnamese American women to take the first steps toward obtaining the recommended screening tests.

**Acknowledgements** This project was supported by grant R01 CA111570 and the TUFCCC/HC Regional Comprehensive Cancer Health Disparity Partnership, Award Number U54 CA221704(5) from the National Cancer Institute. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Cancer Institute or the National Institutes of Health. The authors wish to thank the Asian Community Health Coalition and its member organizations for their collaboration.

**Funding** This research was supported by National Cancer Institute grants U54 CA153513, R01 CA 111570, and U54 CA221705.

## Compliance with Ethical Standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical Approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed Consent** Informed consent was obtained from all individual participants included in the study.

## References

- Wang, S. S., Carreon, J. D., Gomez, S. L., & Devesa, S. S. (2010). Cervical cancer incidence among 6 Asian ethnic groups in the United States, 1996 through 2004. *Cancer*, *116*(4), 949–956. <https://doi.org/10.1002/cncr.24843>.
- Singh, G. K., & Jemal, A. (2017). Socioeconomic and racial/ethnic disparities in cancer mortality, incidence, and survival in the United States, 1950–2014: Over six decades of changing patterns and widening inequalities. *Journal of Environmental and Public Health*, *2017*, 2819372. <https://doi.org/10.1155/2017/2819372>.
- Thompson, C. A., Gomez, S. L., Chan, A., Chan, J. K., McClellan, S. R., Chung, S., Olson, C., Nimbale, V., & Palaniappan, L. P. (2014). Patient and provider characteristics associated with colorectal, breast, and cervical cancer screening among Asian Americans. *Cancer Epidemiology, Biomarkers & Prevention*, *23*(11), 2208–2217. <https://doi.org/10.1158/1055-9965.Epi-14-0487>.
- Do, H. H., Taylor, V. M., Burke, N., Yasui, Y., Schwartz, S. M., & Jackson, J. C. (2007). Knowledge about cervical cancer risk factors, traditional health beliefs, and Pap testing among Vietnamese American women. *Journal of Immigrant and Minority Health/Center for Minority Public Health*, *9*(2), 109–114. <https://doi.org/10.1007/s10903-006-9025-7>.
- Schulmeister, L., & Lifsey, D. S. (1999). Cervical cancer screening knowledge, behaviors, and beliefs of Vietnamese women. *Oncology Nursing Forum*, *26*(5), 879–887.
- Saei Ghare Naz, M., Kariman, N., Ebadi, A., Ozgoli, G., Ghasemi, V., & Rashidi Fakari, F. (2018). Educational interventions for cervical cancer screening behavior of women: A systematic review. *Asian Pacific Journal of Cancer Prevention*, *19*(4), 875–884. <https://doi.org/10.22034/apjcp.2018.19.4.875>.
- Ma, G. X., Fang, C. Y., Feng, Z., Tan, Y., Gao, W., Ge, S., & Nguyen, C. (2012). Correlates of cervical cancer screening among Vietnamese American women. *Infectious Diseases in Obstetrics and Gynecology*, *2012*, 617234. <https://doi.org/10.1155/2012/617234>.
- Ma, G. X., Gao, W., Fang, C. Y., Tan, Y., Feng, Z., Ge, S., & Nguyen, J. A. (2013). Health beliefs associated with cervical cancer screening among Vietnamese Americans. *Journal of Womens Health (Larchmt)*, *22*(3), 276–288. <https://doi.org/10.1089/jwh.2012.3587>.
- Ma, G. X., Fang, C., Tan, Y., Feng, Z., Ge, S., & Nguyen, C. (2015). Increasing cervical cancer screening among Vietnamese Americans: A community-based intervention trial. *Journal of Health Care for the Poor and Underserved*, *26*(2 Suppl), 36–52. <https://doi.org/10.1353/hpu.2015.0064>.
- Strecher, V. J., & Rosenstock, I. M. (2002). The health belief model. In K. Glanz, F. M. Lewis & B. K. Rimer (Eds.), *Health Behavior and Health Education* (2 ed., pp. 41–56). San Francisco: Jossey-Bass.
- Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology*, *52*, 1–26. <https://doi.org/10.1146/annurev.psych.52.1.1>.
- Strecher, V. J., & Rosenstock, I. M. (2002). The health belief model. In K. Glanz, F. M. Lewis & B. K. Rimer (Eds.), *Health behavior and health education: Theory, research, and practice* (2 ed., pp. 41–56). San Francisco: Jossey-Bass.
- Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology*, *52*, 1–26.
- Bandura, A. (2004). Health promotion by social cognitive means. *Health Education & Behavior*, *31*(2), 143–164. <https://doi.org/10.1177/1090198104263660>.
- Baranowski, T., Perry, C. L., & Parcel, G. S. (2002). How individuals, environments, and health behavior interact: Social cognitive theory. In K. Glanz, F. M. Lewis & B. K. Rimer (Eds.), *Health behavior and health education: Theory, research, and practice* (2nd ed., pp. 153–178). San Francisco: Jossey-Bass.
- Fang, C. Y., Ma, G. X., Tan, Y., & Chi, N. (2007). A multifaceted intervention to increase cervical cancer screening among underserved Korean women. *Cancer Epidemiology, Biomarkers & Prevention*, *16*(6), 1298–1302. <https://doi.org/10.1158/1055-9965.epi-07-0091>.
- Ma, G. X., Shive, S. E., Wang, M. Q., & Tan, Y. (2009). Cancer screening behaviors and barriers in Asian Americans. *American Journal of Health Behavior*, *33*(6), 650–660.
- Ma, G. X., Toubbeh, J. I., Wang, M. Q., Shive, S. E., Cooper, L., & Pham, A. (2009). Factors associated with cervical cancer screening compliance and noncompliance among Chinese, Korean, Vietnamese, and Cambodian women. *Journal of the National Medical Association*, *101*(6), 541–551.
- Champion, V. L. (1999). Revised susceptibility, benefits, and barriers scale for mammography screening. *Research in Nursing & Health*, *22*(4), 341–348.
- Kim, S. E., Perez-Stable, E. J., Wong, S., Gregorich, S., Sawaya, G. F., Walsh, J. M., & Kaplan, C. P. (2008). Association between cancer risk perception and screening behavior among diverse women. *Archives of Internal Medicine*, *168*(7), 728–734. <https://doi.org/10.1001/archinte.168.7.728>.
- Lee, Y.-S., Hofstetter, C. R., Irvin, V. L., Kang, S., Chhay, D., Reyes, W. D., & Hovell, M. F. (2012). Korean American women's preventive health care practices: Stratified samples in California, USA. *Health Care for Women International*, *33*(5), 422–439. <https://doi.org/10.1080/07399332.2011.603869>.
- Chilton, J. A., Gor, B. J., Hajek, R. A., & Jones, L. A. (2005). Cervical cancer among Vietnamese women: Efforts to define the problem among Houston's population. *Gynecologic Oncology*,

- 99(3 Suppl 1), S203–S206. <https://doi.org/10.1016/j.ygyno.2005.07.084>.
23. Lee, S.-Y. (2015). Cultural factors associated with breast and cervical cancer screening in Korean American women in the US: An integrative literature review. *Asian Nursing Research*, 9(2), 81–90. <https://doi.org/10.1016/j.anr.2015.05.003>.
24. Tung, W. C., Lu, M., Granner, M., & Sohn, J. (2017). Assessing perceived benefits/barriers and self-efficacy for cervical cancer screening among Korean American women. *Health Care for Women International*, 38(9), 945–955. <https://doi.org/10.1080/07399332.2017.1326495>.
25. Lee, J., & Carvallo, M. (2014). Socioecological perspectives on cervical cancer and cervical cancer screening among Asian American women. *Journal of Community Health*. <https://doi.org/10.1007/s10900-014-9887-x>.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.