Research Article

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Design and Outcomes of a Community Trial to Increase Pap Testing in Pacific Islander Women

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Abstract

Background: Pap tests remain an essential cervical cancer detection method in the United States, yet they are underutilized among Pacific Islanders (PI) who experience elevated cervical cancer incidence and mortality. This study describes the design, methods, participants, and outcomes of a multiyear (2010–2016), community-based randomized intervention trial in southern California. Based upon strong collectivistic norms, the trial tested the efficacy of a unique social support intervention targeting Chamorro, Samoan, and Tongan women and their male husbands/partners.

Methods: A single-session educational intervention was designed and tailored for ethnic- and gender-specific groups to increase men's social support for their female wives/partners to receive a Pap test, and for women to receive a Pap test. The comparison group received preexisting brochures on Pap testing (for women) or general men's health (for men). Pretest and 6-month follow-up data were analyzed.

Results: Intervention and comparison groups were mostly equivalent on pretest demographics and outcome variables. Intervention women who were not compliant with Pap screening recommendations at pretest were significantly more likely to have scheduled and received a Pap test at 6-month follow-up. However, 6-month follow-up results indicated no intervention effect on changes in women's Pap testing knowledge, fatalistic attitudes, or perceived social support from their male partner.

Conclusions: Ethnic- and gender-tailored community interventions can successfully increase Pap test behaviors for PI women, although more research is needed on the specific pathways leading to behavior change.

Impact: Collaborative community-based interventions lead to increases in women's cancer prevention and early detection for Pacific Islander and other collectivistic communities.

Introduction

Pap tests comprise an essential cervical cancer prevention and detection method for women (1). The American Cancer Society (ACS) recommends women ages 21 to 65 receive a Pap test every 3 years. At age 30, women can receive a Pap test every 5 years if combined with a human papillomavirus (HPV) DNA test (2). Even after receipt of an HPV vaccine, current guidelines recommend women over 21 continue receiving regular Pap tests until age 65.

Unfortunately, Pap tests remain underutilized among many ethnic/racial groups, including Pacific Islanders (PI) who originate from the Pacific regions of Melanesia, Micronesia, and Polynesia, and include Chamorros, Fijians, Native Hawaiians, Samoans, and Tongans. PIs experience high rates of cervical cancer incidence and mortality: in the United States, age-adjusted incidence was higher in Samoans (15.1/100,000) and Native Hawaiians (12.3/100,000) compared with non-Hispanic whites (NHWs; 8.1/100,000; ref. 3); in Guam, incidence was higher among Chamorros (14.8/100,000) compared with whites (9.3/100,000; ref. 4). Stage of diagnosis is also later for PIs: nearly 60% of cervical cancers among Native Hawaiian and Samoan women were found at the regional or distant stage, compared to only about 40% among NHWs (3). Finally, mortality was reported to be 5.2/100,000 among Native Hawaiians compared with 2.4/100,000 in NHWs (3).

In 2010, there were over 1.2 million PIs in the United States representing a 40% increase since 2000. Unfortunately, studies found only 46% to 71% of PIs in the United States received a Pap test compared with 95% of the general population (5–8). Significant barriers to Pap testing and other primary care include lower educational attainment, high poverty, and limited English proficiency (9). Studies among aggregated Asian Americans and PIs also documented lower screening among women due to embarrassment with the procedure, cultural modesty, fear of cancer, and fatalistic beliefs that cancer is not preventable (10, 11). Conversely, higher knowledge of Pap test screening guidelines, more positive beliefs about rescreening, and not believing that cancer was "meant to be" were associated with higher Pap testing among Chamorros and Native Hawaiians (12, 13). Social support also appears to be important: the Wai`anae Cancer Research Project found social support from other women increased Pap

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testing compliance among Native Hawaiians by 8% over a 3-year period (14, 15), and we found a significant association between PI women's perceived social support from their husbands and past 3-year receipt of Pap tests (16).

Building upon these past studies, we developed and tested a unique social support-informed intervention targeting PI women and their male supporters to increase Pap testing among Chamorros, Samoans, and Tongans in southern California. In this paper, we describe the study design, methods, participants, and outcomes of this randomized community trial. Specifically, we hypothesized that the social support intervention would significantly increase men's Pap test knowledge and support for PI women, PI women's Pap test knowledge, less-fatalistic attitudes, perceived social support, and PI women's Pap testing behaviors at 6-month follow-up compared with preexisting educational materials.

Materials and Methods

Study design

This multiyear (2010–2016), randomized community trial developed and tested the efficacy of a social support intervention to increase Pap testing among PI women in southern California. Participants were assigned at the organization level (churches for Samoans and Tongans, and clans for Chamorros) to receive either a social support informed intervention session or a usual-care comparison session. Eligible women were Chamorro, Samoan, or Tongan, between the ages of 21 and 65, married or in a relationship with a man for 5+ years, and willing to participate in an educational session and data collection on the day of the education session and 6 months later. Based upon feedback from the study's community advisory board (CAB), women were included even if their husbands/partners refused participation. Furthermore, the study originally aimed to include only PI women who were not up-to-date (i.e., noncompliant) with Pap testing; however, based upon CAB input we extended the study to all women due to concerns regarding both individual rescreening and community equity. Eligible men were married or in a long-term relationship with a participating PI woman, and willing to participate in an educational session and data collection. All protocols and instruments were approved by the university institutional review board, and the project was registered at clinicaltrials.gov following approval of the Consolidated Standards of Reporting Trials (CONSORT) checklist.

Community-based participatory research team

The entire study, from conceptualization to completion, was guided by community-based participatory research (CBPR) approaches involving key personnel from four PI community-based organizations and one university (17). All partners had long-standing research relationships with one another (18), led by 1 community-based investigator and 1 university-based investigator who spearheaded 2 past studies on women's breast cancer screening. Coinvestigators included 2 academic experts, 1 in decision-making theory and 1 in statistics, and the directors of Chamorro, Samoan, and Tongan organizations who collectively had 35 years of experience working in their communities. Study staff included 1 university-based and 1 community-based program manager who coordinated the entire study, and 1 female and 1 male bilingual and bicultural health educator from three PI-serving community organizations (6 health educators in total). Finally, the CAB consisted of 9 leaders, 3 from each community (e.g., PI pastors, clan leaders, and cancer survivors) who provided advice throughout the study. Please see a previous publication for more information about our CBPR processes (19).

Intervention and comparison education

Women's and men's intervention and comparison sessions were conducted separately by a health educator of the same ethnicity and gender. Intervention information originated from the NCI's "What You Need to Know About Cervical Cancer" (20). Educational approaches were further discussed among CBPR partners to identify: (i) community- and culture-specific issues relating to discussing women's health (such as strict taboos against mixed gender discussion for Tongans); (ii) issues relating to spousal social support (such as men's desires to be perceived as in control); (iii) appropriate ways to promote positive images of women and social support for women's health, including the use of spirituality and humor; and (iv) translation needs into Samoan and Tongan languages (with English identified as appropriate for Chamorros). Women's sessions began with a personal sharing exercise as an icebreaker. Next, the health educator provided basic information on cervical cancer, including incidence and prevalence among PIs, risk factors, prevention, and early detection through Pap testing, and how to get a Pap test. A 6-minute video, created in collaboration with PI videographer Mr. Hagoth Aiono, highlighted the importance of Pap testing for PI women and depicted men verbally supporting their women to get tested. The intervention session ended with dissemination of resource lists for low and no-cost Pap tests, verbal commitments and target screening dates recorded on a calendar magnet. Men's education sessions contained similar information, with supplemental information on how to provide support to their wives to get tested. Men's support was also facilitated by the study in 2 ways: men received pre-made woven flowers with instructions to give them to their wives after the educational session ended, and men hand-wrote notes that were mailed to the women by the study team within 2 weeks after the educational session ended.

In the comparison sessions, existing Chamorro, Samoan, and Tongan materials on women's Pap testing and men's general health information were distributed and discussed by the health educators. These materials were developed through a previous CBPR collaborative that was part of the Centers for Disease Control and Prevention's "Racial and Ethnic Approaches to Community Health" program (21).

Measures

Separate women's and men's self-administered pretest surveys and 6-month follow-up surveys were administered. Six-month follow-up surveys also included questions that represented constructs that could potentially change due to the educational sessions. Specific survey items and scales are described below.

Demographic characteristics (pretest only). Demographic variables for men and women included age group, race and ethnicity, church or clan membership, employment status, health insurance coverage, preferred language spoken at home, and years in current marriage/relationship. Based upon evidence suggesting overreporting by ethnic minorities of cancer health behaviors due to acquiescing in interviews (22), social desirability was measured

using Marlowe and Crowe's short form that included 10 dichotomous true/false statements (e.g., I'm always willing to admit when I make a mistake; ref. 23).

Acculturation (pretest only). Higher acculturation has been associated with increased Pap testing among Samoans (24). Thus, among men and women, acculturation to the United States and to the culture of origin was adapted from the Native Hawaiian acculturation modes scale ($\alpha = 0.72$) that uses a 3-point scale to assess knowledge of, involvement in, feelings toward, associating with people from, and importance of native versus American culture and lifestyle (25). The native and the American subscales varied from 1 to 15 points.

Knowledge (pretest and 6-month follow-up). Men and women were asked 12 questions regarding cervical cancer risk factors (e.g., family history of cancer) and when a woman does not need a Pap test (e.g., after menopause, which is false); correct dichotomous answers were summed to calculate a total score (12).

Fatalistic attitudes (pretest and 6-month follow-up). Women's fatalistic attitudes toward cervical cancer and screening (e.g., whether she would undergo cervical cancer treatment) were assessed with five dichotomous agree/disagree questions that were summed to calculate a total score (12).

Social support (pretest and 6-month follow-up). We used the following Medical Outcomes Study social support survey subscales to assess women's perceived social support from their husbands, all with a 5-point Likert scale from strongly disagree to strongly agree. The scales included: (i) instrumental support, 4 items (e.g., "My husband/partner could take me to the doctor if needed"); (ii) emotional support, 3 items (e.g., "My husband/partner showed me love and affection"); (iii) informational support, 4 items (, e.g., "My husband/partner gave me good advice about a crisis"); and (iv) appraisal support, 3 items (e.g., "I could count on my husband/partner to listen to me when I needed to talk"). Answers were summed across all subscales for a total score (26). Men were also asked two dichotomous yes/no questions about whether they talked to their partner about getting a Pap test and whether they intended to talk about it in the future.

Pap testing (pretest and 6-month follow-up). Pap test compliance was assessed at pretest with the question: "When did you have your most recent Pap test?" Based upon ACS guidelines, we categorized women who answered "within the past 3 years" as compliant and all others as noncompliant. At 6-month follow-up, women were asked whether they had scheduled and received a Pap test in the past 6 months.

Translation and pilot testing

The surveys were developed in English, and translated into Samoan and Tongan by bilingual translators. They were independently reviewed by different translators for clarity, simplicity, minimal use of jargon, and utilization of conceptual equivalents for words and phrases. Discrepancies between translators were discussed, with final wordings or phrasings approved by the CAB. Translation of surveys into Chamorro was deemed unnecessary by the staff and CAB members because of the high English fluency in this community. The surveys were pretested with 3 men and 3 women from each community (for a total of 18) who met study inclusion criteria. Each participant completed the survey, then provided verbal feedback on how well they understood the survey questions and answer categories, and what suggestions they had for improvements.

Health educators were trained by the university study staff on the protocols and procedures for survey implementation and delivery of the intervention and comparison education sessions. Over 2 full days and 2 follow-up sessions, health educators reviewed all materials, practiced reading out-loud scripts for informed consent and survey administration, education instructions and information, and role-played in front of one another until they were comfortable with the various educational activities.

Participant recruitment and education

Churches (for Samoans and Tongans) and family clans (for Chamorros) are important social structures for PI communities in the United States (27–29). For this study, lists of Chamorro, Samoan, and Tongan churches and clans in southern California were developed by the 3 community organizations based on their deep knowledge of and experiences with their own communities. Each church/clan was characterized based on ethnic affiliation, preexisting relationships with churches or clans (e.g., joint youth choirs), and the estimated number of female members who would be eligible for the study. They were randomly assigned to either the intervention or comparison arm of the study to achieve balance in ethnicity and minimize contamination.

After providing written informed consent, education sessions were held at convenient meeting places and times, such as in the evenings at churches and community centers. Sessions always involved food and lasted approximately 2 hours. Blinding procedures were not used as it was evident to the health educators and participants whether they received the intervention or comparison session. Participants received a $10 gift card for completion of their assigned session and surveys, and $15 gift card for completing the 6-month follow-up survey.

Sample size

The NIH calculator was used to estimate the sample size requirements for cluster-randomized trials (30), with churches/clans comprising the units of randomization. For sample size estimates of longitudinal analyses involving continuous variables, we specified the type I error rate = 0.05, power = 0.80, analysis of a net difference (the difference between 2 study conditions across 2 time points), an intraclass correlation (ICC) of 0.33 (given the close social relationships between members of the same church/clan), a sample size of 8 participants per church/clan, and an effect size of 0.35 to represent a small-to-medium effect size. With the exception of women's Pap testing, the dichotomous outcome variables were only assessed at 6-month follow-up. Hence, for the dichotomous analyses, we specified a type I error rate = 0.05, power = 0.80, 60% occurrence of the outcome (averaged across the intervention and the comparison groups), analysis of a simple difference (the difference between the intervention and comparison group at 6-month follow-up), and the same sample sizes and effect sizes used for the continuous outcomes. Using these specifications, for continuous variables we estimated that approximately 33 churches/clans per group (intervention vs. comparison) were needed, for a total of 66 clans/churches and a total of 528 female and 528 male participants. For the dichotomous variables, we estimated that only approximately

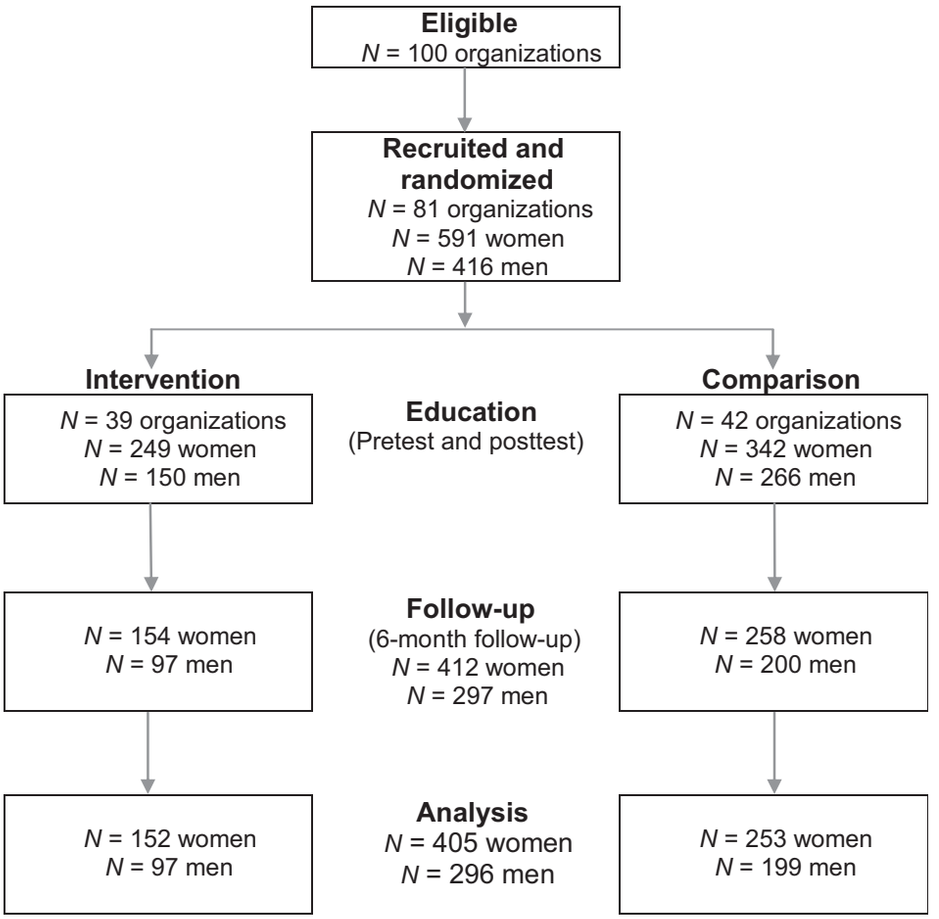

Figure 1.
Study flow diagram. The study CONSORT flow diagram includes the numbers of eligible organizations ($n = 100$), numbers of randomized organizations ($n = 81$) and individuals ($n = 591$ women and $n = 416$ men), numbers of organizations and individuals in each study arm completing pre-/posttests and 6-month follow-up surveys, and the numbers of individuals included in the final analytic samples.

14 churches/clans per group were needed, for a total of 28 churches/clans and a total of 224 female and 224 male participants.

As shown in the CONSORT diagram (Fig. 1), a total of 81 churches and clans participated, resulting in 412 female and 297 male participants who completed the surveys; the intervention group had 39 churches/clans with 154 female and 97 male participants, and the comparison group had 42 churches/clans with 258 female and 200 male participants. Six-month retention rates were 70% for women and 71.4% for men, with reasons for loss to follow-up including nonworking telephone or voicemail (50%), moved and unable to contact (37%), no transportation to meet (10%), and survey too personal (3%). Six women did not answer the Pap test question at pretest and were removed from the data, resulting in a final analytic sample of 405 female participants (152 intervention and 253 comparison), and 296 male participants (97 intervention and 199 comparison).

Although we successfully met our recruitment goal for the number of participating churches/clans, we did not meet the minimum numbers of participants per church/clan. Several factors can attenuate the power of multilevel models, including limited sample sizes and larger intraclass correlations (31). For these reasons, we chose $P \leq 0.10$ as our criterion for statistical significance, rather than the conventional criterion of $P \leq 0.05$, which also reflects Fischer (1950) suggestion that a P value criterion of 0.10 is acceptable (32).

Data management and analyses

Data management. All completed surveys were collected, and data were entered by trained university staff into Statistical Package for Social Sciences (SPSS) for Windows (IBM). Staff members were each assigned batches of surveys to enter, and 10% of all entered data were cross-checked by different staff for accuracy. All of these datasets were merged into one final dataset, where each line represented all waves of data for 1 female participant and her husband/partner (if he participated).

Descriptive statistics. Analyses of pretest data comprised descriptive statistics including frequencies and percentages, means, and standard deviations by intervention and comparison group; bivariate statistics included chi-square statistics for categorical variables and general linear modeling (GLM) for nonnormally distributed continuous variables to compare characteristics of female and male participants by group (intervention vs. comparison).

Intracluster correlation coefficient calculations. GLM was also used to determine whether scores on women's knowledge cervical cancer risk factors, women's fatalistic attitudes, women's perceived social support, and men's knowledge of cervical cancer risk factors varied significantly by church/clan membership. This was done because systematic church/clan-level differences on outcome variables (clustering) could diminish the statistical

power needed to detect intervention versus comparison group effects on longitudinal outcomes. Following Barratt and Kwan's (2009) recommendations, we utilized components of the GLM output to estimate ICCs for each outcome variable, which represents the proportion of total variation in the model that is attributed to between-group variation (33). The ICCs we calculated for the 4 outcome variables were significant and ranged from 0.21 (for women's perceived social support) to 0.33 (for men's knowledge). Because these ICC's were relatively high, we determined that subsequent analyses would account for clustering effects on the outcome variables.

Hypothesis testing for continuous outcomes. GLM mixed models (GLMM) with repeated measures were computed to determine intervention versus comparison group changes from pretest to 6-month follow-up. The continuous outcome variables were: (i) women's and men's knowledge of cervical cancer risk factors, (ii) women's fatalistic attitudes toward cancer, and (iii) women's perceived social support from their husband/male partner. The intervention versus comparison group variable was entered as a fixed effect, and the church/clan variable was entered as a random effect. Since the intervention and comparison group women differed from each other on health insurance coverage and acculturation to the United States, the GLMM models for women's outcomes also included health insurance and acculturation as fixed effect covariates.

Hypothesis testing for dichotomous outcomes. The 6-month follow-up dichotomous outcome variables were: (i) women's Pap test scheduling, (ii) women's Pap test receipt, (iii) men's talking about Pap tests to their female partners, and (iv) men's encouragement of Pap tests to their female partners. Each of these variables was entered in GLMM models, with church/clan as a random effect. The repeated measures option was not utilized in these models because, with the exception of receiving a Pap test, the outcomes were not assessed at pretest. However, similar to the analyses of the continuous outcomes, the fixed predictor variable for each of the models was intervention versus comparison group and the random effect was participants' church/clan membership. Fixed covariates for the women's outcomes were health insurance coverage and acculturation to the United States, and the fixed covariate for the men's outcomes was ever having recommended their wife/female partner to receive a Pap test. These analyses were run twice: once for all women (and their husbands/male partners) and once for only women who were Pap compliant at pretest (and their partners, because they were thought to differ from Pap noncompliant women and their male partners).

For all of the women's outcomes listed in hypothesis testing sections above, we re-ran the analyses to include only women whose male partners also participated in the education session. This was done to determine whether men's participation in the intervention may have increased intervention effects.

Results

At pretest the majority of PI women were 40 years and older, employed, had health insurance, and spoke at least some English (Table 1). Slightly over half were up-to-date with recommended Pap test frequency. The only group-level differences were health insurance coverage and acculturation to the United States: intervention group women had a higher percentage of insurance coverage ($P = 0.05$) and were less acculturated to the United States ($P = 0.03$) compared with comparison group women. There were no differences in social desirability. Therefore, health insurance and acculturation were included as covariates in subsequent analyses for women. The majority of men were also 40 years and older, employed, had health insurance, and spoke at least some English. No group differences were found for any of the men's demographic variables, although comparison men were slightly more likely to have suggested Pap testing to their

Table 1. Demographic characteristics of study women and men at pre-test, by group in Southern California

	Women				Men			
	Intervention ($n = 249$) *n* (%)	Comparison ($n = 342$) *n* (%)	Total ($n = 591$) *n* (%)	X^2 (*P*)	Intervention ($n = 150$) *n* (%)	Comparison ($n = 266$) *n* (%)	Total ($n = 416$) *n* (%)	X^2 (*P*)
Age in years								
21–29	41 (16.6)	81 (23.8)	122 (20.8)	5.05 (0.17)	24 (16.3)	57 (22.2)	81 (20.0)	2.08 (0.56)
30–39	53 (21.5)	68 (19.7)	120 (20.4)		35 (23.8)	55 (21.4)	90 (22.3)	
40–49	69 (27.9)	95 (27.6)	163 (27.7)		37 (25.2)	59 (23.0)	96 (23.8)	
50+	84 (34.0)	98 (28.8)	182 (31.0)		51 (34.7)	86 (33.5)	137 (33.9)	
Employed	130 (53.1)	182 (53.5)	312 (53.3)	0.94 (0.63)	92 (62.6)	175 (67.8)	267 (65.9)	1.42 (0.49)
Insured	202 (82.8)	259 (76.0)	461 (78.8)	3.98 (0.05)	104 (70.7)	194 (74.0)	298 (72.9)	0.52 (0.47)
Language at home								
PI only	14 (5.8)	16 (4.8)	30 (5.2)	3.43 (0.49)	11 (7.5)	16 (6.1)	27 (6.6)	1.06 (0.90)
More PI	25 (10.3)	28 (8.3)	53 (9.2)		13 (8.8)	31 (11.7)	44 (10.7)	
Both PI/English	104 (42.8)	146 (43.5)	250 (43.2)		57 (38.8)	100 (37.9)	157 (38.2)	
More English	58 (23.9)	70 (20.8)	128 (22.1)		27 (19.7)	51 (19.3)	80 (19.5)	
English only	42 (17.3)	76 (22.6)	118 (20.4)		37 (25.2)	66 (25.0)	103 (25.1)	
Pap compliant[a]	129 (52.2)	182 (53.8)	311 (53.2)	0.15 (0.70)	39 (26.9)	55 (36.9)	94 (32.0)	3.39 (0.07)
Pap intention[b]	64 (54.2)	80 (51.6)	144 (52.7)	0.19 (0.67)	116 (78.9)	181 (71.8)	297 (74.4)	2.45 (0.12)
Acculturation	M (SD)	M (SD)	M (SD)	F (p)	M (SD)	M (SD)	M (SD)	F (p)
To the United States	11.88 (2.16)	12.26 (2.00)	12.09 (2.08)	4.98 (0.03)	12.06 (2.18)	11.89 (2.39)	11.96 (2.32)	1.04 (0.35)
To PI culture	13.29 (1.74)	13.37 (1.72)	13.34 (1.72)	0.32 (0.57)	13.05 (1.80)	13.06 (2.06)	13.06 (1.97)	0.00 (0.99)

[a]Women were asked whether they had received a Pap test within the past 3 years, and men were asked if they had ever recommended to their wife/partner that she should receive a Pap test.

[b]Women were asked whether they had intentions to receive a Pap test within next 6 months. This variable was answered only among women who had not received a Pap test within the past 3 years. Men were asked about their intentions to support their female partner to receive a Pap test in the near future.

Table 2. Changes from pretest to 6-month follow-up on continuous outcomes in Southern California

	Intervention		Comparison		Fixed Effects		
					Intervention vs. comparison group	Health insurance coverage	Acculturation to the United States
	Pretest	Follow-up	Pretest	Follow-up	β	β	β
	n	*n*	*n*	*n*	SE	SE	SE
	M	M	M	M	95% CI	95% CI	95% CI
	SD	SD	SD	SD	*P*	*P*	*P*
Women's knowledge	135	135	218	218	0.134	0.452	0.097
	5.08	6.39	5.28	6.08	0.286	0.232	0.046
	2.56	2.53	3.04	2.64	−0.428, 0.696	−0.004, 0.908	0.008, 0.186
					0.640	**0.052**	**0.034**
Women's fatalistic attitudes	129	129	211	211	−0.109	−0.185	−0.059
	1.08	0.71	1.19	0.84	0.146	0.097	0.019
	1.08	1.10	1.28	1.20	−0.395, −0.176	−0.376, −0.006	−0.10, −0.02
					0.452	**0.058**	**0.002**
Women's perceived social support	135	135	225	225	0.802	−0.771	0.607
	50.21	50.61	52.29	51.20	0.881	0.782	0.151
	9.99	9.69	8.56	10.37	−0.926, 2.53	−2.307, 0.764	0.310, 0.903
					0.363	0.324	**0.000**
Men's knowledge	103	103	99	99	0.515	N/A	N/A
	3.17	5.77	3.84	5.38	0.524		
	2.69	2.59	2.79	3.03	−0.520, 1.549		
					0.328		

partners in the past ($P = 0.07$). Hence, no covariates were included in subsequent men's analyses.

Longitudinal results, continuous outcomes

Table 2 shows pretest to 6-month follow-up GLMM repeated measures results of women's outcomes and men's outcomes. For both intervention and comparison groups, women increased their knowledge about cervical cancer risk factors and decreased their fatalistic attitudes toward cancer, and men increased their knowledge about cervical cancer risk factors. However, there was no significant intervention versus comparison group effect for any of the Pap test outcomes. Among the covariates, acculturation to the United States was significantly associated with longitudinal outcomes. Regardless of group assignment, women who were more acculturated to the United States were more likely to increase their knowledge about cervical cancer risk factors and decrease their fatalistic attitudes toward cervical cancer during the study period. Similarly, women who were more acculturated to the United States were more likely to increase their knowledge about cervical cancer risk factors. The results were similar among only those women who had a male partner in the study. Specifically, there were no intervention effects on changes in women's knowledge of cervical cancer risk factors ($P = 0.726$), women's fatalistic attitudes toward cancer ($P = 0.934$), and women's perceived social support ($P = 0.754$).

Longitudinal results, dichotomous outcomes

Table 3 presents 6-month follow-up results for dichotomous outcomes for women who were not compliant with Pap tests at pretest. Women in the intervention group were more likely to have scheduled a Pap test (55.4%) and received a Pap test (51.4%) by 6-month follow-up compared with women in the comparison group (40.2% and 34.9%, respectively). The results

Table 3. Intervention versus comparison group results at six-month follow-up for dichotomous outcomes in Southern California[a]

			Fixed effects		
			Intervention vs. comparison group	Health insurance coverage	Acculturation to the United States
	Intervention	Comparison	*B* (SE)	*B* (SE)	*B* (SE)
	n (%)	*n* (%)	95% CI	95% CI	95% CI
			P	*P*	*P*
Scheduled Pap test	41 (55.4)	43 (40.2)	0.757 (0.403)	0.068 (0.366)	0.016 (0.080)
			−0.04, 1.553	−0.655, 0.791	−0.142, 0.174
			0.062	0.853	0.840
Received Pap tests	38 (51.4)	37 (34.9)	0.820 (0.451)	0.044 (0.391)	0.115 (0.086)
			−0.071, 1.171	−0.728, 0.816	−0.055, 0.286
			0.071	0.910	0.184
Man talked to woman about Pap test[b]	38 (73.1)	45 (53.6)	0.153 (0.560)	N/A	N/A
			−0.959, 1.264		
			0.785		
Man encouraged woman to get Pap test[b]	35 (71.4)	43 (52.4)	0.354 (0.525)	N/A	N/A
			−0.689, 1.396		
			0.502		

[a]Sample limited to women who were not compliant with Pap tests at pretest.
[b]Analyses were adjusted for men's report at pretest that they had, at least once, recommended to their wife/female partner to have a Pap test.

were similar among only those women who had a male partner in the study.

Discussion

This community randomized trial was unique in its inclusion of both men and PI women to increase Pap testing among Chamorros, Samoans, and Tongans. The results showed that both intervention and comparison education increased women's and men's knowledge about cervical cancer risk factors, although knowledge gains were higher among intervention men. Interestingly, we found that women's perceived social support did not increase in either group, perhaps due to the limitations of health education to change the multiple constructs (e.g., emotional and instrumental) involved in social support (34). Social desirability bias was not a factor in any analyses, and thus we suggest it is not necessary to include in future studies.

Overall, the main study hypothesis was confirmed: the intervention resulted in significant increases in Pap testing among intervention compared with comparison women who were not previously complaint with testing. However, we found no intervention effect on changes in women's Pap testing knowledge or fatalistic attitudes, which was similar to a previous study of Pap testing among Samoans (35) and suggests that cognitive changes can be achieved without significant additional cultural tailoring beyond existing in-language materials. Unfortunately, despite our intense efforts to increase behavioral changes in the intervention group, our resulting Pap testing rates remained below Healthy People 2020's goals of 93% screening (36). Given the differences in PI community organizations including churches and clans, this enduring disparity underscores the importance of the NCI's Cancer Moonshot priority areas of dissemination and implementation research to identify the conditions under which interventions are more widely transferred and adopted by organizations within and beyond the community (37). To this aim, we developed a toolkit to promote dissemination of the study materials and methods for other PI and disparity populations, available at http://wincart.fullerton.edu/cancer_edu/Toolkit.htm.

Although encouraged by our overall findings, we recognize several study limitations. Data were based upon self-reports and not verifiable by objective measures such as clinic charts for Pap test history. We also had a larger loss to follow-up than anticipated, although our ability to retain 70% of women despite significant socioeconomic barriers (e.g., low employment) speaks to the value of CBPR to engage and retain PI women through organizational sampling. In addition, because specific questions were omitted from the survey to protect privacy, it is not certain whether our sample was generalizable to larger populations of Chamorros, Samoans, and Tongans in the United States. For instance, we did not ask questions regarding immigration status; hence, we do not know what proportion of our Samoan and Tongan samples were undocumented, which could have had significant impacts on their Pap testing behaviors (38).

Despite these limitations, our overall increases in women's Pap testing behaviors indicate that collaborative community-based studies have the potential to address cancer health disparities in PI and other underserved communities. We urge more cancer health disparity research for PIs in the future, particularly those that harness trusted community entities using community-based health educators to disseminate cancer prevention and early detection messages. We also underscore the importance of oversampling PIs in all studies to ensure power to detect statistically significant outcomes, and exploring whether acculturation differentially influences PIs from U.S. territories (American Samoa and Guam) compared with independent countries (Kingdom of Tonga). Finally, the educational aspects of our intervention concluded prior to full-implementation of the U.S. Affordable Care Act, and thus we are hopeful that future studies achieve Healthy People objectives by linking PI and other medically underserved populations to ongoing Pap testing and other crucial primary care services.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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