RESEARCH ARTICLE

Increasing Awareness of Gynecologic Cancer Risks and Symptoms among Asian, Native Hawaiian and Pacific Islander Women in the US-Associated Pacific Island Jurisdictions

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Abstract

Background: Gynecologic cancers are common among Asian/Native Hawaiian/Pacific Islander (A/NH/PI) women. Prevention is important in United States associated Pacific Island jurisdictions (USAPIJ) because there are limited resources to treat cancer. The objective of this study was to educate A/NH/PI women and providers about evidence-based interventions to prevent and control gynecologic cancers in Yap, one of four major islands comprising the Federated States of Micronesia (FSM). This was done through a partnership between Inside Knowledge: Get The Facts About Gynecologic Cancer national campaign and the Yap comprehensive cancer control program, both funded by the Center for Disease Control and Prevention (CDC). **Methods:** Inside Knowledge educational materials were obtained from the CDC website and used in facilitated educational sessions. Sessions were planned according to leading health education theories, and were implemented and led by local Yap public health practitioners. Pre- and post-session surveys were used to assess changes in gynecologic cancer awareness, confidence and behavioral intentions related to prevention/early detection for gynecologic cancer. **Results:** Twenty-nine providers and 326 adult women participated in sessions. All participants demonstrated significant increases in knowledge across all measured domains post-session. Public knowledge that HPV causes cervical, vulvar and vaginal cancer increased from 4.9% pre-session to 51.4% post-session ($p<0.0001$); provider knowledge increased from 17.2% to 96.6% ($p<0.0001$). Significantly more women identified smoking as a cervical cancer risk factor post-session (increased from 53.8% to 98.7% [$p<0.0001$]). An average of 61.4% of providers said they were extremely or somewhat confident in their gynecologic cancer knowledge pre-session compared to 91.7% post-session. **Conclusion:** Targeted education about gynecologic cancer symptoms and risk factors can be effective at increasing awareness, behavioral intention, confidence and knowledge. These increases can lead to more widespread prevention of these five cancers.

Keywords: Cancer prevention- gynecologic cancer- cancer education- health education

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Introduction

Gynecologic cancers are common among Asian and Pacific Islander (API) women in the United States (US) (USCS Working Group, 2016). API cancer incidence rates for the female genital system are higher than that for the respiratory system, and are exceeded only by digestive system and breast cancer rates (USCS Working Group, 2016). The US has several associated Pacific Island jurisdictions (USAPIJ), for which support is provided for the development and implementation of local public health programs. Yap (population 11,376) is one of four major islands comprising the Federated States of Micronesia (FSM). The nation lacks many resources that could prevent, diagnose and treat cancers, including gynecologic cancers (Cancer Council of the Pacific Islands, 2014). FSM spends $260 per capita on health, a fraction of the US $8,233 figure, and receives funding from the Center for Disease Control and Prevention's (CDC) National Comprehensive Cancer Control Program (NCCCP). However unlike other USAPIJs, FSM does not receive funding from the CDC's National Breast and Cervical Cancer Early Detection Program (NBCCEDP) (Cancer Council of the Pacific Islands, 2014; Townsend et al., 2014). Although cervical cancer is the third-most common cancer among FSM women, it lacks the capacity to process Pap tests and recently has lacked funds to send cytology slides off-island (American College of Obstetricians and Gynecologists, 2015; Cancer Council of the Pacific Islands, 2014; Townsend et al., 2014.) The nation employs

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no pathologists, radiologists or oncologists, and also lacks on-island chemotherapy or radiation, instead referring to the Philippines or Hawaii for definitive cancer diagnosis and treatment.

Given the elevated cervical cancer rate and limited gynecologic cancer treatment options on Yap or throughout Micronesia, prevention of gynecologic cancers is a public health priority. As HPV-related cancers can be eliminated with vaccination, ensuring that medical providers understand HPV vaccination recommendations is of paramount importance (Harper et al., 2006; Kim and Goldie, 2008). Additionally, interaction with medical providers is limited on outlying islands like Yap. Ensuring women know when to seek vaccination for themselves or their children is equally crucial in reducing HPV-related cancers (American College of Obstetricians and Gynecologists, 2015). Educational resources on the signs, symptoms, risk factors and prevention for gynecologic cancers (cervical, ovarian, uterine, vaginal and vulvar) are available through CDC's Inside Knowledge: Get the Facts About Gynecologic Cancer (Centers for Disease Control and Prevention, 2015; Rim et al., 2011).

In this study, in order to promote knowledge and awareness of cervical and other gynecologic cancers, the FSM Yap Comprehensive Cancer Control program, funded by CDC's NCCCP, partnered with the Inside Knowledge campaign to provide educational materials to local medical providers and women, and facilitate discussions about these materials. We report on changes in gynecologic cancer knowledge and associated behavioral intentions among these participants.

Materials and Methods

Participants and Sessions

Multiple methods were used to recruit healthcare providers and adult women, including flyers, radio ads, and direct outreach from healthcare workers, community leaders, elders and health assistants. Five municipalities covered by the Wa'ab Community Health Center sites, spanning most of Yap, were targeted in recruitment as were women on three neighboring islands. The resulting sample was representative of the state's population and women who face significant barriers in seeking gynecologic care (American College of Obstetricians and Gynecologists, 2015). Twenty public sessions were held on Yap and surrounding islands; four provider sessions were held on Yap and three were held on neighboring islands. All session participants were at least 18 years old.

Facilitated discussion sessions followed a standardized format, designed in concordance with three health education theories: the health behavior model, self-efficacy model, and theory of planned behavior (Ajzen, 1991; Bandura, 1977; Hayden, 2014). A facilitator (A.T.) designed a PowerPoint presentation to lead participants through an educational discussion of Inside Knowledge materials, including print brochures, gynecologic cancer fact sheets, symptoms diaries and survivor stories (Centers for Disease Control and Prevention, 2015). Facilitators conducted discussions primarily in English, however, local translators were available when needed. Additionally, key concepts were translated into Yapese, Ulithian, Woleaian, Satawalese and Tagalog. Public participants received $10 and providers were eligible for CME credit.

To assess the changes in knowledge, related attitudes and behaviors, participants completed identical questionnaires before and after facilitated discussion. Questionnaires were tested for usability prior to use. Questions were all close-ended, were either multiple choice, five-item Likert scales, or true/false, and were developed in accordance with the three health education theories above. Questions assessed participants' retention of key messages from the Inside Knowledge campaign, such as HPV vaccination recommendations. Finally, some questions assessed demographics and providers' practice characteristics.

Data Collection

Questionnaires were not linked by individual in order to preserve privacy. Hardcopies completed at the sessions were entered into an electronic database using Snap Survey Software (Snap Surveys; Thornbury, England). Data was checked for quality, and data entry errors were corrected.

CDC review deemed the study to represent public health practice, thus exempting it from Institutional Review Board (IRB) review. Additionally, the US OMB approved this study, including its data collection and questionnaires (OMB control number 0920-0800). All participants provided their informed consent to participate.

Statistical Analysis

Prior to analysis, demographic categories collapsed as needed to ensure infrequent responses did not compromise confidentiality. Age was grouped as under 35, 35-44, 45-54, or at least 55, and race was grouped as into Asian/Native Hawaiian/Pacific Islander or other.

Some questions allowed for multiple correct responses. In this case, new dichotomous variables were created to delineate between: 1) all of the correct answers and no incorrect answers selected; or 2) any other response. Finally, as most participants selected high ratings on all Likert scale questions, dichotomous variables were created that categorized respondents as either: 1) extremely or somewhat likely or confident; or 2) neutral/neither likely nor unlikely, or not very or not at all likely or confident. For agree/disagree questions, public respondents' answers were coded into the dichotomous variables of: 1) strongly agree or agree; or 2) neutral, disagree, or strongly disagree. However, providers' answer choices for agree/disagree questions replaced "neutral", with "somewhat agree", resulting in corresponding dichotomous variables of: 1) strongly agree, agree or somewhat agree; or 2) disagree or strongly disagree. For all variables, participants who did not answer the question or responded "does not apply" were excluded from the denominator in calculations.

Demographic characteristics of respondents, including age and race, and, for providers, gender, specialty, work environment and patients seen per day were characterized. Pre- and post-session differences were analyzed; domain areas of awareness, behavioral intentions, and level of confidence concerning gynecologic cancers were assessed.

All analysis was conducted with SAS 9.3 (SAS Institute, Inc.; Cary, NC). P values were derived from chi square or Fisher's exact tests for categorical variables and used a significance level of alpha = 0.05.

Results

Table 1 provides demographic characteristics of the participants. Most (63.8%) public respondents were under 35; a vast majority (91.9%) were Asian/Native Hawaiian/Pacific Islander (A/NH/PI). Most public participants had graduated high school/GED program (28.9%) or completed some college (24.1%), though 39.2% participants had not started or completed high school. Providers encompassed a wide range of ages, were twice as likely to be female as male, and almost all (93.1%) A/NH/PI.

The provider sample included seven doctors (25.9%), specializing in family medicine (n=3), general medicine (n=2) and obstetrics/gynecology (n=2). Most remaining providers were nurses (25.9%) or community health workers (22.2%). Most providers worked in both inpatient and outpatient settings (53.6%) or exclusively in outpatient settings (32.1%); most providers (53.6%) estimated seeing between 10 and 20 patients daily. Pre-session, 55.6% of providers and 41.4% of public respondents were aware of the Inside Knowledge campaign. A majority of public respondents were aware of cervical (71.7%), uterine (68.0%), vaginal (58.3%) and ovarian (55.3%) cancers, while only 26.7% were aware of vulvar cancer.

Table 2 shows pre- and post-session provider and public knowledge of gynecologic cancer risk factors. Among the public, with the exception of the association of uterine cancer and advanced age or menopausal/postmenopausal status (7.4% pre-session, 7.8% post-session, p=0.8551), public knowledge increased significantly post-session (p<0.0001) for all assessed risk factors. Among providers, significantly more providers identified family history

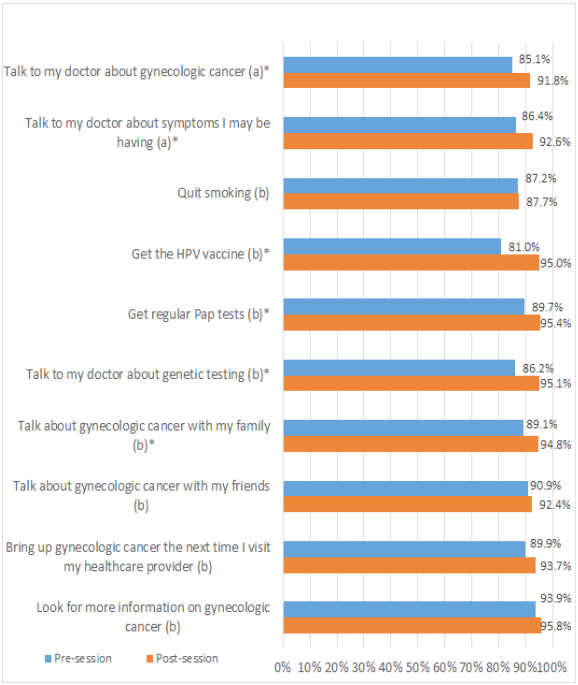

Figure 1. Pre-and Post-Session Public Respondent Cconfidence (a) or likelihood (b) in taking specified action. Percentage includes ratings "extremely confident" or "somewhat confident" or "extremely likely" or "somewhat likely". Asterisks indicate p<0.05. HPV vaccine question applies only to age-eligible women.

Table 1. Demographics

	Public, n=326 % (n)	Providers, n=29 % (n)
Age (years)		
< 35	63.8% (206)	24.1% (7)
35-44	20.4% (66)	24.1% (7)
45-54	10.8% (35)	31.0% (9)
55+	5.0% (16)	20.7% (6)
Race		
Asian/Native Hawaiian/Pacific Islander	91.9% (295)	93.1% (27)
Other	8.1% (26)	6.9% (2)
Education Level		
Some high school or less	39.2% (122)	N/A
High school graduate/GED	28.9% (90)	N/A
Some college	24.1% (75)	N/A
College graduate or higher	4.8% (15)	N/A
Other	2.9% (9)	N/A
Sex[a]		
Male	N/A	33.3% (9)
Female	N/A	66.7% (18)
Specialty[a]		
Family Medicine	N/A	11.1% (3)
General Medicine	N/A	7.4% (2)
Obstetrics/Gynecology	N/A	7.4% (2)
Nurse practitioner/Physician's Assistant	N/A	11.1% (3)
Nurse	N/A	25.9% (7)
Community health worker	N/A	22.2% (6)
Other	N/A	14.8% (4)
Work Environment[a]		
Inpatient	N/A	3.6% (1)
Outpatient	N/A	32.1% (9)
Combination	N/A	53.6% (15)
Other	N/A	10.7% (3)
Average Patients seen per day[a]		
<10	N/A	25.0% (7)
10-20	N/A	53.6% (15)
21-30	N/A	10.7% (3)
31+	N/A	7.1% (2)
Not Sure	N/A	3.6% (1)
Pre-session Awareness		
Inside Knowledge campaign	41.4% (133)	55.6% (15)
Cervical cancer[a]	71.7% (215)	N/A
Ovarian cancer[a]	55.3% (166)	N/A
Uterine cancer[a]	68.0% (204)	N/A
Vaginal cancer[a]	58.3% (175)	N/A
Vulvar cancer[a]	26.7% (80)	N/A

Missing responses were excluded; N/A, not applicable; [a], Questions were only asked of providers.

Table 2. Risk Factors, Vaccination, Testing, and Diagnostics for Gynecologic Cancer

Question	Public, n=326			Providers, n=29		
	Pre-session knowledge % (n)	Post-session knowledge % (n)	P value[a]	Pre-session knowledge % (n)	Post-session knowledge % (n)	P value[a]
Ovarian cancer						
Family history	69.0% (223)	87.2% (280)	<0.0001	65.5% (19)	96.6% (28)	0.0054
Never giving birth/infertility	43.3% (140)	74.8% (240)	<0.0001	69.0% (20)	86.2% (25)	0.207
Ashkenazi Jewish background	6.2% (20)	68.9% (221)	<0.0001	6.9% (2)	72.4% (21)	<.0001
All correct responses	0.9% (3)	42.7% (137)	<0.0001	0.0% (0)	65.5% (19)	<.0001
Uterine cancer						
Menopausal/ post-menopausal status/advanced age	7.4% (24)	7.8% (25)	0.8551	28.6% (8)	31.0% (9)	0.839
HPV-associated cancers						
HPV causes cervical, vaginal, and vulvar cancer	4.9% (16)	51.4% (165)	<0.0001	17.2% (5)	96.6% (28)	<0.0001
Smoking increases cervical cancer risk	53.8% (172)	98.7% (308)	<0.0001	72.4% (21)	93.1% (27)	0.0787
HPV vaccine						
Recommended for 11 and 12 year old girls	42.6% (138)	67.1% (214)	<0.0001	48.3% (14)	62.1% (18)	0.2909
Safe for girls age 9 and older	N/A	N/A		69.0% (20)	96.6% (28)	0.0119
Recommended for girls and women ages 13 to 26 who have not been vaccinated	64.8% (210)	86.2% (275)	<0.0001	44.8% (13)	75.9% (22)	0.0307
All correct responses	13.6% (44)	39.5% (126)	<0.0001	6.9% (2)	48.3% (14)	0.0008
Cervical cancer screening						
Only cervical cancer has an effective screening test	39.6% (125)	74.9% (236)	<0.0001	89.3% (25)	79.3% (23)	0.4703
It is appropriate to give the Pap test every three years	N/A	N/A		69.0% (20)	82.8% (24)	0.2197
The Pap test only screens for cervical cancer	21.2% (67)	49.7% (159)	<0.0001	65.5% (19)	79.3% (23)	0.2399
Genetic testing						
Genetic testing is available for uterine and ovarian cancer	1.9% (6)	36.7% (117)	<0.0001	10.3% (3)	42.9% (12)	0.007

[a], *p* values from chi square tests or Fisher's exact test; Missing responses were excluded; N/A, not applicable

(65.5% pre-session, 96.6% post-session, p=0.0054), Ashkenazi Jewish background (6.9% pre-session, 72.4% post-session, p<0.0001), or all of those answers along with nulliparity/infertility (0% pre-session, 65.5% post-session, p<0.0001) as risk factors for ovarian cancer. Post-session, nearly all providers identified that HPV causes cervical, vaginal and vulvar cancers (17.2% pre-session, 96.6% post-session, p<0.0001) and that smoking increases risk of cervical cancer (93.1% post-session). However, less than one-third of providers identified advanced age or menopausal/postmenopausal status as a uterine cancer risk factor.

Table 2 also shows knowledge of gynecologic cancer vaccination for HPV-associated gynecological cancers, testing and diagnostic facts. Public participants (p<0.0001) increased post-session knowledge for all assessed facts. About 37% of respondents were able to recall post-session that genetic testing is available for uterine and ovarian cancer (1.9% pre-session, 36.7% post-session) and that only cervical cancer has an effective screening test (39.6% pre-session, 74.9% post-session).

After the facilitated discussion, providers were significantly more likely to know that the HPV vaccine is safe for girls at least nine years old (69% pre-session, 96.6% post-session, p=0.012), that catchup vaccination is recommended for girls and women ages 13 to 26 who did not receive a complete set of vaccinations (44.8% pre-session, 75.9% post-session, p=0.0307), or that HPV vaccination is recommended for girls ages 11 and 12 (6.9% pre-session, 48.3% post-session, p=0.0008). Significantly more providers also knew that genetic testing is available for uterine and ovarian cancers (10.3% pre-session, 42.9% post-session, p=0.0070).

Table 3 assesses public respondents' awareness and knowledge regarding gynecologic cancer. At least two-thirds of participants affirmed all statements concerning the importance of gynecologic cancers, with significant increases in the percent agreeing that gynecologic cancer is a problem for themselves (58.6% pre-session, 75.6% post-session, p<0.0001) or in their families (50.8% pre-session, 66.7% post-session, p=<0.0001). Over 98% of public respondents knew pre- and post-session to seek immediate medical care for abnormal bleeding and discharge. Otherwise, knowledge of each sign or symptom significantly increased post session.

Figure 1 examines public respondents' behavioral intention and level of confidence concerning gynecologic cancer. Post-session, at least 90% of respondents rated themselves somewhat or extremely likely or confident to take actions related to gynecologic cancer, with 87.7%

Table 3. Gynecologic Cancer Awareness, Symptom Knowledge, and Intentions among Women and Providers Attending Inside Knowledge Educational Sessions

Question	Public, n=326			Providers, n=29		
	Pre-session knowledge % (n)	Post-session knowledge % (n)	P value[a]	Pre-session agreement	Post-session agreement	P value[a]
Awareness of gynecologic cancer[b]						
Gynecologic cancer is an important health issue	96.0% (308)	97.8% (312)	0.1774	--	--	--
Women should be aware of signs and symptoms	96.2% (306)	96.5% (304)	0.8499	--	--	--
Gynecologic cancer is a problem for me	58.6% (188)	75.6% (236)	<.0001	--	--	--
Gynecologic cancer is a problem in my family	50.8% (162)	66.7% (210)	<.0001	--	--	--
Gynecologic cancer is an important health issue	--	--	--	93.1% (27)	100% (29)	0.4912
Providers should make a strong effort to promote appropriate screening guidelines	--	--	--	93.1% (27)	100% (29)	0.4912
Gynecologic cancer is a problem for my patient population	--	--	--	93.1% (27)	100% (29)	0.4912
Symptom Knowledge						
Pelvic pain/pressure	55.1% (178)	72.4% (226)	<.0001	0 (0.0)	3.5% (1)	1
Abnormal bleeding/discharge	86.4% (279)	93.0% (290)	0.0067	4 (14.3)	46.4% (13)	0.0186
Abdominal/back pain	49.9% (161)	65.4% (204)	<.0001	--	--	--
Bloating	23.5% (76)	77.9% (243)	<.0001	--	--	--
Change in bathroom habits	52.6% (170)	82.7% (258)	<.0001	--	--	--
Itching or burning of the vulva	64.7% (209)	89.4% (279)	<.0001	--	--	--
Changes in vulva color or skin	58.5% (189)	85.6% (267)	<.0001	--	--	--
All correct	4.6% (15)	28.9% (90)	<.0001	--	--	--
Seek medical care if signs/symptoms last for two weeks or more	9.3% (30)	83.7% (262)	<.0001	--	--	--
See a doctor immediately for abnormal bleeding/ discharge	99.4% (322)	98.7% (310)	0.4442	--	--	--
Intentions[c]						
Educate my patients appropriately about	--	--	--	93.1% (27)	100% (29)	0.4912
gynecologic cancer risk and symptoms						
Assess symptoms of gynecologic cancer in my patients and conduct appropriate tests	--	--	--	89.3% (25)	100% (29)	0.112
Refer patients suspected of a gynecologic cancer to a gynecologic oncologist	--	--	--	93.1% (27)	100% (29)	0.4912

[a]*p* values from chi square tests or Fisher's exact test; [b]Percentages represent women who responded agree/strongly agree; [c]% Somewhat Likely, Extremely Likely; Missing responses or "does not apply" responses were excluded.

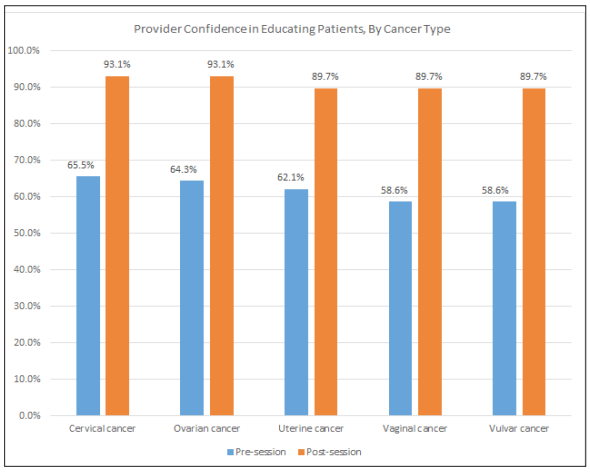

Figure 2. Pre- and Post-Session Provider Confidence in Educating Patients about Gynecologic Cancer, by Type. Percentage includes ratings of "extremely confident" or "somewhat confident" in Educating Patients. All p values<0.05.

of public respondents likely to quit smoking. Ninety-five of the 100 public respondents under age 25 thought themselves somewhat or extremely likely to receive HPV vaccination, increasing from 81 pre-session (p=0.0039), and 92.6% of public respondents felt extremely or somewhat confident in talking to their doctor about symptoms they may be having, compared to 86.4% pre-session (p=0.0113).

Post-session, providers also scored highly on measures of awareness, confidence, and intention, as shown in Table 3. All 29 providers affirmed statements assessing the perceived importance of gynecologic cancer, and thought themselves somewhat or extremely likely to take relevant actions related to patient education, clinical examination and testing, and referral to gynecologic oncologists. Because at least 25 of the 29 providers responded affirmatively to each of these questions pre-session, however, no statistically significant changes were noted. Nearly all providers failed to identify pelvic pain/pressure as a sign or symptom of each of cervical, ovarian, uterine

and vaginal cancer pre- or post-session, and under half identified abnormal bleeding or discharge as symptoms of ovarian, uterine and vulvar cancers (14.3% pre-session, 46.4% post-session, p=0.0186).

In Figure 2, providers demonstrated significantly increased confidence in their knowledge about gynecologic cancers, with 58.6% to 65.6% of providers extremely or somewhat confident in their pre-session knowledge of each cancer, versus 89.7% to 93.1% of providers extremely or somewhat confident in their post-session knowledge of each cancer.

Discussion

Our study findings demonstrate significant increases in the proportion of public participants and providers in Yap expressing correct knowledge, awareness and behavioral intent with regards to gynecologic cancer after participations in facilitated discussions. Of particular note are the results concerning HPV, including knowledge that HPV cause cervical, vaginal, and vulvar cancers. Similarly, post-session, at least 95% of public respondents stated they were somewhat or extremely likely to get regular Pap tests and the HPV vaccine. While patient knowledge concerning Pap tests also increased significantly, we observed a more modest, non-significant increase in provider knowledge for Pap tests. Finally, in contrast, age or menopausal/postmenopausal status as a uterine cancer risk factor stood out for lack of uptake for both providers and public respondents.

Given Yap's cervical cancer burden, HPV vaccination efforts are a public health priority for the island. FSM has a national HPV immunization program that mandates each of its states to administer the vaccine, and the FSM Department of Health and Social Affairs has rated HPV vaccination and cervical cancer prevention as a top priority (Obel et al., 2015; World Health Organization, 2016). However, FSM's 2013 HPV vaccination coverage rates varied by island from less than 5% to 89% (Obel et al., 2015). FSM's overall HPV vaccination rate is thus under 60%, as is the case in nearby islands (Obel et al., 2015). Programmatic efforts, like the one presented here, may assist with increasing vaccination rates.

Regionally, the most-cited barriers to HPV vaccination programs are concerns over funding and the lack of visible endorsement from government officials; although in Yap parental non-consent has been cited as a central barrier (Obel et al., 2015). Concern over the values and safety of the vaccine is the third most-cited barrier, though practice may not bear out those concerns: a 2008 CDC-supported effort in Northern Mariana Islands provided 73% of high school girls with their first HPV vaccination dose, and fears of community rejection never materialized (Obel et al., 2015; Sablan, 2008). The Vaccine Alliance (GAVI) has negotiated a lowered price of $4.50 per HPV vaccine for low-income countries, and though FSM's per capita income is too high to meet GAVI eligibility, it is suggested that a coordinated regional effort with other Pacific Island nations could result in reduced vaccine cost, improved technical expertise and, ultimately, increased vaccination rates (GAVI, 2013; Obel et al., 2015).

Our finding that Pap test knowledge did not increase significantly among providers may reflect the fact cervical cancer screening in FSM is completed among women aged 25–45 years using visual inspection with acetic acid (VIA) at least twice in a lifetime (Townsend et al., 2014). This standard of care is in place primarily due to the absence of laboratories to interpret Pap tests. Additionally, the finding that most providers did not know Ashkenazi Jewish heritage as a risk factor for ovarian cancer is not unexpected for a provider population that overwhelmingly treats patients of Asian/Native Hawaiian/Pacific Islander descent. Future gynecologic cancer education in this region can use materials that are adapted to emphasize locally-relevant subpopulations, screening and testing procedures.

Uterine cancer risk factor knowledge remained low after the sessions were complete among all participants. Because of Yap's shorter life expectancy and since uterine cancer usually occurs at more advanced ages, this may not be a disease of major concern in this population (Howden and Meyer, 2011; United Nations Population Fund, 2011). However, given its association with obesity and the prevalence of obesity in the USAPIJ, additional education of women and providers about uterine cancer risk factors may be warranted (Anderson et al., 2016; Novotny et al., 2016). Development of educational materials specific to the USAPIJ populations may be beneficial in providing this education. Other education efforts in Yap have focused successfully on obesity (Anderson et al., 2016; Novotny et al., 2016), and could be extended to include uterine cancer.

Our study has several strengths and limitations. Among strengths, this public health intervention used scientifically and medically-vetted materials to teach an underserved population facing unique logistical challenges in accessing regular medical care. Local programs led the facilitated discussions, reached a diverse and representative cross-section of Yap's population. The recruitment of patients on outlying islands allowed for inclusion of women who face additional barriers in seeking screening or preventive interventions for gynecologic cancers. Among limitations, our assessment of knowledge increases was based on immediate recall, as opposed to longer-term retention. Because Yapese culture has well-defined gender roles, with peacemaker and consensus-builder among women's traditional jobs, this may artificially inflate scores on awareness, behavioral intention or level of confidence assessments, if respondents thought researchers desired responses of "likely", "confident" or "agree" (Micronesian Seminar, 1994). Participants also may have been more likely to not respond if they did not know the answer to a factual recall question, which could create a positive bias in results. However, no increases were seen in knowledge of uterine cancer risk factors, increasing the likelihood that the study's other reported knowledge differences are real and not artifact.

Our study showed that for gynecologic cancer, national educational campaign materials used by local programs can be very effective at increasing knowledge, behavior and intentions among hard-to-reach and/or underserved populations. Education and prevention are especially crucial in minimizing gynecologic cancer burden in

settings without the screening and treatment capabilities of the US, such as Yap. Continued use of Inside Knowledge materials in other USAPIJ and areas with similar challenges could improve patient and provider knowledge and empowerment, ultimately reducing gynecologic cancer burden. This study also provides a resource for USAPIJ public health practitioners across all diseases for how to adapt national messaging and create local context to help prevent and control disease in their communities.

Conflict of Interest

The authors have no conflicts of interest to disclose.

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Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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