

RESEARCH ARTICLE

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Cervical Cancer and HPV Knowledge and Awareness: An Educational Intervention among College Students in Guam

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Abstract

Background: Compared to the U.S. population, cervical cancer (CC) incidence is significantly higher among the CHamoru, Micronesian, and Caucasian populations in Guam. From 2008-2012, CC was the fifth most common cancer diagnosed on the island. Despite the prevalence of CC and low HPV vaccine uptake, there is a concerning lack of awareness and preventative behavior among young adults. This study was aimed at influencing college students' knowledge and awareness of CC, CC screening, HPV, and the HPV vaccination. **Methods:** We delivered a 30-minute educational intervention to a sample of 108 university students in a classroom setting. The effect of the educational intervention was measured through a pre-and post-test on CC and HPV health behaviors, knowledge, and awareness. Results were analyzed using SPSS and an exact McNemar's test was used to examine the difference in the proportion of correct answers to the tests. Two-way mixed ANOVA was used to examine between (gender, ethnicity, and class level) and within subjects (pre-and post-test) program effects. **Results:** Of the 108 participants, only 39 (36.1%) reported being vaccinated for HPV, 23 (21.3%) had not been vaccinated, and 46 (42.6%) did not know if they had been vaccinated for HPV. Only forty-one (60.3%) female participants had had a Pap smear. When comparing the pre-to-posttest responses, most questions had an increase in correct responses. Time also influenced CCA and HPV knowledge and awareness scores as there was a significant increase in scores from the pre- to post-test. **Conclusion:** The educational intervention was an effective tool for increasing knowledge and awareness of CC, HPV, and HPV vaccination among college students. While study results demonstrate the educational intervention's success as a baseline measure of knowledge, the inclusion of behavioral outcome measures, such as intent to get vaccinated or screened, could result in more robust future studies.

Keywords: Vaccine uptake- education- prevention

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Introduction

The incidence of cervical cancer (CC) in Guam, a United States (U.S.) territory in the Western Pacific, is six times higher among Micronesians and over three times higher for CHamorus (Guam's indigenous people) and Caucasians living in Guam than the U.S. population (David, 2015). While it is an unincorporated territory of the U.S., Guam is geographically located in Asia and 33.6% of its population is Asian (including Korean, Japanese, Chinese, and other ethnic groups, with Filipinos making up 26.3%) (Central Intelligence Agency, 2022). In 2021, it was estimated that 14,480 new cases of invasive cervical cancer will be diagnosed in the United States, with 4,290 women dying from this cancer (American Cancer Society, 2022). As it usually takes 15 to 20 years

to develop, it is diagnosed most often in females between the ages of 35 to 44 years old (World Health Organization, 2020; American Cancer Society, 2022).

According to the Guam Cancer Facts & Figures 2008-2012, cervical cancer was the fifth most common cancer in Guam. With 130 cases diagnosed between 2008 to 2012, CC accounted for 6.8% of all cancer cases (David, 2015). Invasive CC ranked as the fifth leading cause of cancer-related death in females. With 9 cases recorded, it accounted for 3.4% of all cancer-related deaths for females (David, 2015).

Almost all cases of cervical cancer are caused by human papillomavirus (HPV), the most common sexually transmitted infection (STI) in the United States (Patel et al., 2012). HPV occurs more frequently in sexually active young adults. In Guam, there were 200

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cases of HPV reported from 2013 to 2018 (Pobutsky et al., 2020). Nationally, an estimated 26 million new STI cases were identified in 2018. Over half of those were in young adults between the ages of 15 to 24 years old (Centers for Disease Control and Prevention, 2021). Since young adults may be at higher risk for HPV infection, the need for educational intervention in this age group is critical.

Educational interventions are particularly crucial among college students who can still get the HPV vaccine, which is recommended for young men and women up to 26 years old. Coupled with the risk of HPV, there is a concern about the potential lack of cervical cancer prevention behaviors in younger women, who should start getting screened for CC at 21 years old.

Three recent studies conducted on university students found that a lack of knowledge on CC and HPV is an obstacle to screening and HPV vaccination. Shin et al., (2021) identified several barriers to cervical cancer screening among female students in Korean universities. One of the primary barriers was limited knowledge about CC screening and HPV vaccination (Shin et al., 2021). Notably, they found that participants misunderstood the association between CC screening and HPV vaccination and had insufficient information on screening (Shin et al., 2021). Similarly, Dönmez et al., (2019) surveyed female first-year nursing students in Turkish universities and found low levels of knowledge on HPV, HPV vaccine, and cervical cancer, with “*individuals with higher knowledge and perceived threat ... more likely to engage in healthy behaviors*” (Dönmez, 2019). On the other hand, “*students with low level of knowledge about HPV had not believed in the protective nature of HPV vaccine*” which hindered HPV vaccine uptake (Dönmez, 2019). Consequently, students who lacked knowledge about the vaccine’s effectiveness were less likely to adopt preventive behaviors for cervical cancer. A 2018 survey conducted by Kellogg et al., (2019) on Los Angeles County college students came to a similar conclusion that “*respondents with a higher level of self-perceived or actual knowledge level of HPV were more likely to be vaccinated.*” Interestingly, respondents who were vaccinated (62%) reported higher scores on the HPV knowledge questions in comparison to the unvaccinated (40%) (Kellogg et al., 2019). This may indicate that being more aware of HPV is associated with increased likelihood of being vaccinated. The researchers argue that increasing education on HPV infection may help improve vaccine uptake. All three studies recommend educational interventions to expand students’ access to information on cervical cancer and HPV and increase their knowledge. Their findings demonstrate that perceived barriers to CC preventive behaviors may decline as knowledge on these health topics increase.

A 2020 study by Gollu and Gore (2021) supports the assertion that a lack of knowledge and awareness about the HPV vaccine is a barrier to vaccination. This study surveyed 150 second and third-year students from the Vydehi Medical College in Bangalore, India. Compared to female students (91.2%), a smaller percentage of male students (61.4%) knew that the HPV vaccine could be given to boys. However, only 35.7% of male respondents

were willing to receive the vaccination compared to 92.5% of female respondents (Gollu and Gore, 2021). A lack of knowledge of the vaccine’s availability for males influenced the behavior of male respondents, as they were less willing to receive the HPV vaccine despite HPV being a risk factor for penile, anal, and oropharyngeal cancers. Aside from knowledge, beliefs also influence willingness to receive the HPV vaccine.

Beliefs about the HPV vaccine also influence health behaviors. Hayes et al., (2019) found “*strong relationships between health beliefs and HPV vaccine receipt.*” Health beliefs such as “*safety and cost of the vaccine, low perceived susceptibility to HPV, low perceived severity of HPV, and low perceived benefits from the vaccine*” influenced the likelihood of being vaccinated (Hayes et al., 2019). Mo et al., (2013) also found that “*a lack of knowledge about HPV and its link to cervical cancer had an impact on female college students’ cervical cancer prevention behaviors.*” Multiple studies have endeavored to address these barriers for young adults using educational interventions.

Studies have emphasized the need for educational interventions to promote CC preventive behaviors among female college students. A study by Mo et al., (2013) examined the behavior of unvaccinated female Korean college freshman and sophomores. As they explain, “*Korean women in their 20s and 30s are relatively less aware than women in their 40s and 50s of cervical cancer’s severity and the importance of early check-ups for cervical cancer...*” (Mo et al., 2013). As cervical cancer develops over the course of 15 to 20 years, females in their early 20s must adopt behaviors to prevent the potential development of this cancer in their late-30s to 40s. The authors suggest that knowledge deficiency, perception of barriers, and a lack of perceived benefits may hinder the adoption of preventive behaviors, such as receiving the HPV vaccine.

Educational interventions for college undergraduate students have been effective in changing perceptions and improving knowledge, increasing the intent to practice preventive behaviors. Hayes et al., (2019) performed pharmacy student-led educational sessions intended to address health beliefs on HPV vaccinations. Attending the educational sessions “*was associated with increased perceived benefits of and decreased perceived barriers to HPV vaccination, both predictors of vaccination...*” (Hayes et al., 2019). Their intervention was successful in changing perceptions which increased the likelihood of receiving the HPV vaccine. Mo et al., (2013) also conducted a peer-led educational program aimed at promoting cervical cancer preventive behaviors in their target population. The effectiveness of this tool was demonstrated in the study’s one-month follow-up which found that “*female college students in the experimental group reported reduced participation in high-risk sexual behaviors*” (Mo et al., 2013). Additionally, the educational intervention improved the perceived benefits of the vaccine. This program was “*effective at increasing the intent to practice cervical cancer prevention behaviors*” (Mo et al., 2013).

Not all cervical cancer educational interventions have

yielded successful outcomes, however. A study by Patel et al., (2012) endeavored to increase HPV vaccination uptake in unvaccinated female college students below 26 years old. After the intervention, the researchers found only 6% (n=14) of study participants received at least one dose. Despite the lack of success in increasing uptake, the study drew one similar conclusion to Hayes et al.,(2019) Health beliefs influence one's intent to receive the vaccine. As explained, "*perceived parental approval, perceived vulnerability to genital HPV infection, and belief that HPV vaccine is important to maintaining health were also significantly associated with HPV vaccine intent...*" (Patel et al., 2012). The likelihood that an individual intends to receive the vaccine is affected by their perceptions of those factors.

Educational interventions have proven to be a valuable tool in reaching the young adult population and promoting preventive behaviors, especially HPV vaccination. These studies support the assertion that health beliefs influence the intent of individuals to adopt cervical cancer preventive behaviors. On the strength of these previous findings, we conducted an educational intervention in Guam with undergraduate college students to influence their knowledge and awareness of cervical cancer, which in turn may affect their behavior.

The purpose of the study was to influence college students' knowledge and awareness of cervical cancer, cervical cancer screening, human papillomavirus (HPV), and the HPV vaccination. The study provided educational outreach to a sample of the university student population. It was designed to meet five objectives. First, to measure whether educational outreach with college students will increase awareness and knowledge of cervical cancer, HPV, available screening tests for cervical cancer, and HPV vaccination. Second, to determine the baseline level of participant knowledge about cervical cancer and its association with the HPV. Third, to share current guidelines for cervical cancer screening. Fourth, to promote education about HPV vaccination as a means of preventing cervical cancer and other HPV-related cancers. Finally, to share an available local resource that offers free cervical cancer screening for eligible uninsured/underinsured women.

Materials and Methods

Our team designed and delivered a 20-30 minute presentation to college students in a classroom setting. The educational intervention was conducted at a university in Guam. This school is a U.S. land-grant public comprehensive university that is also a member of the Asian American and Native American Pacific Islander Serving Institution (AANAPISI) Program, which is one of six types of Minority Serving Institutions (MSI) (U.S. Department of Health and Human Services Office of Minority Health, 2020). It has a student population of 3,449 composed primarily of Pacific Islanders (46%) and Asians (46%) as of Fall 2020 (Office of Institutional Effectiveness, 2022). The majority of the undergraduates are between the ages of 19 -29 years old, and more than half (52%) are females (Office of Institutional

Effectiveness, 2021).

Faculty at the college were asked to allow the research team to utilize about 30 minutes of their instructional time to introduce the study, complete the informed consent forms, conduct the pre- and post-tests, and conduct the presentation. The research team went to the classrooms of the faculty who agreed to participate in the study. Care was taken to ensure that the presentations were consistent in the different classrooms. A script was developed for the introduction of the study, and the presentation was carefully rehearsed to ensure that the length was comparable in all the classrooms, apart from the duration of the question-and-answer time after the presentations. The college students in the study constituted a convenience sample, as it depended upon the willingness of faculty members to allow the presentation to be conducted in their classes. Therefore, the generalizability of the study's findings to the university population may be limited.

Data Analysis

Data generated from the survey questions were entered and analyzed using Statistical Package for Social Sciences (SPSS), version 27. An exact McNemar's test was used to examine the difference in the proportion of correct answers for each survey question. A compound score was developed for the Cervical Cancer (CCA) and HPV Knowledge and Awareness having a total sum of seventeen items and a possible range of scores from 0 to 25. Two-way mixed ANOVA was used to examine between (gender, ethnicity, and class level) and within subjects (pre-and post-test) program effects. CCA and HPV Knowledge and Awareness total pre- and post-means with standard errors (SEs) and 95% confidence intervals for the differences were reported by gender, ethnicity, and class level.

Instrument

The pre-test and the post-test included questions testing knowledge and awareness of cervical cancer and the human papillomavirus. The questions are based on fact sheets and other online sources provided by the Centers for Disease Control (CDC) on the topics. The participants were asked to identify symptoms of cervical cancer (CC), its primary cause, risk factors associated with the disease (including smoking, having multiple sexual partners, a family history of CC, etc.), screening tests to detect CC, as well as what one can do to prevent CC.

Results

The educational intervention was conducted in the college classroom setting. A total of 108 students participated in the study and completed the pre-test and post-test surveys. These students came from seven (7) undergraduate classes from a variety of academic disciplines including Communication, Social Work, Health Science, Political Science, and English.

Most participants were female (63.0%), juniors (44.4%), and more than half identified as either CHamoru (36.1%) or Filipino (26.9%). Most of them had a regular source of healthcare (77.8%), a primary physician (56.5%), and private health insurance (52.8%).

Table 1. Participant Demographic Information and Healthcare Behaviors Related to Cervical Cancer and HPV

Question	Answer	N	%
Sex	Female	68	63.0
	Male	40	37.0
Class Level	Sophomore	7	6.5
	Junior	48	44.4
	Senior	38	35.2
	Other (Graduate)	14	13.0
Race/ Ethnicity	CHamoru	39	36.1
	Filipino	29	26.9
	Caucasian	4	3.7
	Pacific Islander	20	18.7
	Other	15	14.0
Regular Physician	Yes	61	56.5
	No	44	40.7
Health Care Plan/ Insurance			
Private health insurance (through employer)		57	52.8
	Medicaid	4	3.7
	Medicare	1	0.9
	Tricare	16	14.8
	No insurance	24	22.2
	Other	7	6.5
Vaccinated for HPV (both genders)	Yes	39	36.1
	No insurance	23	21.3
	Don't know	46	42.6
Family diagnosed w/ CC (both genders)	Yes	12	11.1
	No	67	62.0
	Don't know	29	26.9
Females Only (N=68)			
Pap Smear	< 3 years	34	50.0
	>=3 years	7	10.0
	Never	26	38.0
	Missing	1	1.0
Ever had an HPV test	Yes	27	39.7
	No	25	36.8
	Don't know	4	5.9
	Missing	12	17.6
Diagnosed w/ cervical cancer	Yes	1	1.5
	No	64	94.1
	Don't know	3	4.4

The participants represented various class levels and ethnic groups. Most participants were females (63.0%) and either Juniors (44.4%) or Seniors (35.2%). More than half of the participants identified as either CHamoru (36.1%) or Filipino (26.9%). The majority of the participants reported having a regular source of healthcare (77.8%) and more than half (56.5%) had a primary physician and private health insurance (52.8%). However, 22.2% of the participants did not have any health coverage at all.

In addition to the demographic information, the participants were also asked to provide information regarding their health behaviors related to CC and HPV. The results are presented in Table 1. Some questions were asked of both male and female participants, while questions about CC were asked only of the female participants. As Table 1 shows, only thirty-nine (36.1%) of all participants had been vaccinated for HPV, twenty-three (21.3%) said they had not been vaccinated for HPV, while forty-six (42.6%) did not know if they had been vaccinated for HPV. Twelve participants (11.1%) had a family member diagnosed with CC, sixty-seven (62%) did not have any CC diagnosis in their family, and twenty-nine (26.95) did not know of any diagnosis.

Of the questions asked only of female participants (N=68), thirty-four (50.0%) had had a Pap smear less than three years ago, while seven (10.0%) had one more than three years ago. Twenty-six participants (38.0%) have never had a Pap smear and one participant (1.0%) did not answer the question. Twenty-seven (39.7%) noted that they ever had an HPV test, twenty-five (36.8%) said they had never had one, and four (5.9%) did not know if they ever had one. Twelve participants (17.6%) did not answer the question. One participant (1.5%) had been diagnosed with CC, sixty-four (94.1%) had not, while three (4.4%) did not know.

Pre-test and post-test comparisons

The participants' scores on the pre-tests and post-tests were compared to determine if there were any significant differences in the scores as a result of the educational intervention. The McNemar's test shows that there are significant positive differences in the proportion of correct responses to most of the questions between the pre- and post-test. The percentages of correct answers to questions related to symptoms and causes of CCA, the increased risk caused by HPV, and the prevention of CCA through routine screening scored highly in the pre-test so the difference was not significant. The results are presented in Table 2.

Knowledge and Awareness

Three individual two-way mixed ANOVAs with Gender (male, female), Ethnicity (Chamorro, Filipino, Caucasian, Pacific Islander, Other), and Class Level (Sophomore, Junior, Senior, Other) as the factor were performed using the total score of the CCA and HPV Knowledge and Awareness as the dependent variable. There was no significant interaction between Gender (F=0.498, p=0.482), Class Level (F=0.371, p=0.774), or

Table 2. Pre Versus Post Presentation, Comparison of Knowledge Scores

Questions	Correct Answer	Pre N (%)	Post N(%)	p-value*
Cervical cancer is located in	Cervix	99 (91.7)	108 (100.0)	0.004
Symptoms of cervical cancer include				
Vaginal bleeding	True	78 (72.2)	100 (92.6)	<0.001
Pain during intercourse	True	71 (65.7)	102 (94.4)	<0.001
Unusual vaginal discharge	True	80 (74.1)	97 (89.8)	0.002
Pelvic pain	True	88 (81.5)	93 (86.1)	0.332
Stomach pain	False	55 (50.9)	104 (96.3)	<0.001
The primary cause of cervical cancer is:	HPV (Human Papillomavirus)	104 (96.3)	103 (95.4)	1.000
What increases the risks of getting cervical cancer?				
Smoking	True	29 (26.9)	101 (93.5)	<0.001
Chlamydia infection	True	45 (41.7)	25 (23.1)	0.003
Human Papillomavirus (HPV) infection	True	100 (92.6)	101 (93.5)	1.000
Having multiple sexual partners	True	56 (51.9)	100 (92.6)	<0.001
Using birth control for over 5 years	True	23 (21.3)	56 (51.9)	<0.001
Family history of cervical cancer	True	87 (80.6)	66 (61.1)	0.001
Exposure before birth to DES (Diethylstilbestrol, a hormone once prescribed to pregnant women)	True	24 (22.2)	43 (39.8)	0.007
Who has to worry about HPV (Human Papillomavirus) infections?	Both men and women	78 (72.2)	107 (99.1)	<0.001
Who should get the HPV Vaccine?	Both men and women	85 (78.7)	102 (94.4)	0.001
What screening tests detect cervical cancer?	Both Pap smear and HPV test	90 (83.3)	91 (84.3)	1.000
At what age should women get their first pap test?	21 years old	31 (28.7)	96 (88.9)	<0.001
In general, a woman should have a pap test every _____ until the age of 65.	3 years	32 (29.6)	89 (82.4)	<0.001
How can you prevent cervical cancer?				
Don't smoke	True	35 (32.4)	101 (93.5)	<0.001
If you are sexually active, use a condom every time you have sex	True	67 (62.0)	102 (94.4)	<0.001
Get vaccinated for HPV	True	96 (88.9)	105 (97.2)	0.012
Women should be routinely screened for cervical cancer	True	97 (89.8)	104 (96.3)	0.065
Where can a woman get a pap test?	All the above	98 (90.7)	106 (98.1)	0.021
If cervical cancer is caught at the earliest stage, the chance of survival is more than ____ percent.	85	60 (55.6)	99 (91.7)	<0.001

*Using McNemar's test; Boldface indicates significant value.

Table 3. CC¹ Knowledge and Awareness*

	N	Pre-Mean (SE)	Post-Mean (SE)	Post-Pre Mean difference 95% CI
Gender				
Male	40	15.70 (0.52)	21.50 (0.40)	(4.93, 6.82)
Female	68	15.89 (0.46)	21.19 (0.39)	(4.46, 6.19)
Ethnicity				
CHamoru	39	15.95 (0.55)	21.51 (0.32)	(4.41, 6.67)
Filipino	29	16.17 (0.67)	21.55 (0.58)	(4.21, 6.45)
Caucasian	4	19.25 (1.45)	22.75 (0.66)	(1.50, 5.75)
Pacific Islander	20	14.00 (0.75)	19.90 (0.85)	(4.40, 7.45)
Other	15	16.25 (0.90)	21.75 (0.76)	(3.94, 7.19)
Class Level				
Sophomore	7	18.14 (1.50)	22.86 (0.23)	(1.86, 7.43)
Junior	48	15.56 (0.52)	20.88 (0.44)	(4.29, 6.33)
Senior	38	15.97 (0.52)	21.76 (0.35)	(4.87, 6.68)
Other(Graduate)	14	15.36 (0.89)	21.43 (0.86)	(4.29, 7.79)

*Highest Possible Score, 25; ¹CC - cervical cancer

Ethnicity ($F=0.398$, $p=0.810$).

The results of this analysis showed a significant main effect of Time on CCA and HPV Knowledge and Awareness ($p<0.001$). Post-hoc tests using the Bonferroni correction revealed that there was a significant increase in CCA and HPV Knowledge and Awareness scores from pre- to posttest in all groups. The pre- and posttest means, standard errors, and 95% confidence intervals (CIs) for mean differences are presented in Table 3.

Discussion

The results of this study suggest that study participants perceived the educational intervention in their academic setting to be an effective tool to increase knowledge and awareness about cervical cancer (CC), HPV, and HPV vaccination. The classroom context, primed as it is already for learning, created the readiness for responding positively to the presentation. Prior to the session, 63.9% of the participants rated their general knowledge about CC as neutral or unknowledgeable (scoring less than 18). After the presentation, this score decreased to 11.1%.

The results highlight the need for more educational interventions particularly for this age group of young adults, while some men and women can still get the HPV vaccine and women are at the age of initial CC screening. It is interesting to note that almost half of the participants did not know if they have been vaccinated against HPV (42.6%), as shown in Table 1. Only 36.1% knew that they had the vaccine and 21.3% knew that they did not get vaccinated against HPV. Furthermore, 11.1% of the participants claim that a member of their family has been diagnosed with CC. These findings highlight the lack of communication about the HPV vaccine and the protection it offers against CC and other cancers, which may be related to the persistent myth that it could lead to promiscuous behavior, particularly among younger adults. Apart from the information shared in educational interventions such as the present study, communication about CC and HPV vaccines in other contexts (e.g., family and friendship networks) is needed to minimize or eliminate biases or perceptions that the topics are taboo.

These results, however, may not be representative of the student population of the university. Aside from the relatively small sample size, more representation from freshmen and sophomores may provide more insights. The sample did not include any freshmen and only 6% were sophomores. It should be noted that lower-class students represented 47% of all students enrolled at this university (Office of Institutional Effectiveness, 2021) in Fall 2020.

Future studies may need to refine the instrument used in the pre- and post-test. Specifically, the post-test should ask participants to indicate behavioral intention to get the HPV vaccine, if qualified, and to get screened for CC (in the case of females over 21 years old). A question about willingness to talk about younger family members getting vaccinated may also be added. Furthermore, a follow-up survey to determine if behavior change was made (i.e., HPV vaccination, CC screening done) may be conducted. Future studies could test presentation paired

with opportunities for HPV vaccination via college or public health services.

Findings from this study indicate that the college setting is an appropriate venue to increase CC and HPV awareness and potentially impact HPV vaccination for both females and males. While study results demonstrate the educational intervention's success as a baseline measure of knowledge, a more robust intervention should include behavioral outcome measures in future studies.

Author Contribution Statement

All authors contributed equally in this study.

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