Knowledge, Attitudes, Beliefs, Practices Regarding Human Papillomavirus (HPV), and Barriers to Vaccination Against HPV Infection: A Cross-Sectional Survey of Guam Residents

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Abstract

Human papillomavirus (HPV) is the most common sexually transmitted infection in the United States and is linked to several cancers. In Guam, the HPV vaccination rate falls short of the National Healthy People 2030 goal. Only half of eligible Guam teens have received the HPV vaccination series. Additionally, research on Guam HPV vaccination is limited. A cross-sectional survey was conducted, and a representative sample of Guam residents (n=775) was surveyed to examine their knowledge, attitudes, beliefs, practices regarding HPV, and barriers to HPV vaccination. Aggregated scores were calculated for these scale items: attitude, knowledge, subjective norms, and perceived behavioral control regarding HPV. One-way Analysis of Variance (ANOVA) was used to compare the means of the scores and check for significant differences. Binary logistic regression helped to identify significant predictors of HPV vaccination among respondents with children. Significant differences were found for sex, education, income, and ethnicity. Women and those with higher education and income demonstrated higher positive attitudes and knowledge about HPV vaccination. Also, those with health insurance and those who were advised by their physician were more likely to get their children vaccinated. These results will guide the implementation of effective strategies for developing targeted behavioral and other appropriate interventions to increase HPV vaccination in Guam.

Keywords

Guam, Human papillomavirus, HPV, HPV Vaccine, Vaccination

Abbreviations and Acronyms

ANOVA = Analysis of Variance
DPHSS = Department of Public Health and Social Services in Guam
HPV = Human Papillomavirus

Introduction

Human papillomavirus (HPV) infections have been causally linked to cervical, anal, vaginal, vulvar, penile, and oropharyngeal cancers.[1] Generally, all cervical cancers are due to HPV infection.[2] The American Cancer Society estimated that in 2022 there were 14 100 new cervical cancer cases and 4280 deaths in the United States (US).[3] Guam is a US territory in the Western Pacific with approximately 170 000 people. According to Guam Cancer Facts and Figures 2013-2017, cervical cancer incidence in Guam (9.8 per 100 000) was 1.3 times higher than in the US (7.4 per 100 000) and accounted for 3% of all cancer deaths in Guam.[4]

Genital HPV is the most common sexually transmitted infection in the US.[5] Approximately 70% of cervical cancers are attributable to HPV 16 or 18.[2] Cervical cancer is the most common HPV-associated cancer among women, and oropharyngeal cancers are the most common among men.[6] Cervical cancer was the fifth most common cancer and the fifth cause of death of females in Guam.[4]

In the US, a quadrivalent HPV vaccine known as Gardasil® is approved for females and males aged 9-26.[7] In 2021, only 64% of girls and 60% of boys 13-17 in the US were up to date with the HPV vaccination series.[3] Only 53.6% of girls and 41.7% of boys 13-17 in Guam completed the HPV vaccination series in 2020.[8] The HPV vaccine is an effective means to protect against oncogenic HPV infection and HPV-related cancers. It is also most effective when initiated before the onset of sexual activity and exposure to HPV.[9] Giving the vaccine at an early age is important. However, the immunization rate remains low in the US and Guam.

Although HPV vaccination coverage has increased in the US since 2006, it remains short of the National Healthy People 2030 goal to have at least 80% of adolescents between the ages of 13-15 years complete the HPV vaccine series.[10] Minors must get the permission of their parents to receive vaccinations. There are numerous reasons for vaccine refusal parents, including concern about safety, mistrust of vaccines, and religious or philosophical beliefs.[11-12] Prior studies have attempted to characterize the factors influencing parental awareness of HPV and HPV vaccines.[13-14] This study sought to assess the knowledge, attitude, and beliefs of a convenience sample of the adult population in Guam and to examine barriers to HPV vaccination uptake. Guam adults aged 18 years and older represent 73% of the population.[15] Individuals with and without children were included in the survey. Those without children were included because in the future they may become parents faced with deciding whether to vaccinate their children. To date, no studies conducted in Guam have investigated these factors. This study aimed to provide insight into population-specific strategies to advise future efforts to increase HPV vaccination coverage and recommend appropriate interventions to decrease HPV-related cancers in Guam.

Methods

Participants and Procedures

From March 1 to December 1, 2017, a cross-sectional survey of adult Guam residents, with or without children, was conducted. Inclusion criteria included: at least 18 years old, and able to consent, read and understand English. A convenience, multi-cluster sampling method was used. Guam was divided into 3 regions: northern, central, and southern. Two villages and 2 study sites were identified from each region, with a targeted sample of 200 for each. The Guam Community College and the University of Guam were added as study sites and assigned a sample of 100 per site. A total of 775 hard copy surveys were completed in person. No incentives were provided for participation. Recruitment was done by placing posters in stores and bulletin boards of schools, churches, and offices. Flyers were distributed at community and outreach events.

Development of the Survey Tool

The study was based on the Theory of Planned Behavior. This psychological model posits that attitude, subject norms, and perceived behavioral control shape an individual's behavioral intentions and behaviors.[16] The survey questionnaire was in English and self-administered on paper that consisted of 13 'true or false' questions, and 4 'check all' that apply items. Questions were modified from previous studies [16-18] that used the Theory of Planned Behavior to address the research objectives. The survey questionnaire was pilot tested with 20 men and women to gauge user-friendliness and revised based on feedback.

The survey questionnaire had 5 sections: demographic information, HPV knowledge, attitude toward the HPV vaccine, subjective norms, and perceived behavioral control, specifically difficulty acquiring the vaccine. The source of information was measured by asking, "Where did you learn about HPV vaccination?" HPV vaccine uptake was only measured for respondents with children by 1 item, "My child/children had the HPV vaccination." One item measured the intention to vaccinate the child: 'I will have my children get the HPV vaccine if the doctor tells me.'

Measurement and Data Analysis

Data from the survey were cleaned and analyzed using SPSS Version 26 (IBM Corp, Armonk, NY). Frequencies, percentages, mean scores, and standard deviations for all variables were calculated. The psychological constructs were measured using the aggregated scores calculated for attitude (sum of 5 items, range of values 0 to 5), knowledge (sum of 17 items, range of values 0 to 17), subjective norms and perceived behavioral control regarding HPV combined (sum of 5 items). Higher scores meant more positive outcomes for variables (ie, a positive attitude, perception of behavioral control, or subjective norm). One-way ANOVA was used to compare the means of the score and to check for significant differences for each category by sex, ethnicity, education level, and income. Binary logistic regression analysis was conducted for the association between socio-demographic variables, attitude, knowledge, subjective norms and perceived behavioral control, and the intention to get the HPV vaccine (dependent variable).

Ethics Approval and Consent

This study was approved by the Institutional Review Board of the University of Guam (CHRS #17-05). Participants gave written informed consent.

Results

Sample Characteristics

Table 1 summarizes the sample demographic characteristics. A total of 775 individuals participated in the study, with the majority being CHamorus (47.2%) and Filipinos (26.1%). Chuukese, Pohnpeian, and other Pacific Islanders were categorized as Micronesian (11.4%). The age distribution of participants was as follows: 18-30 years old (45.1%), 30-40 years old (16.8%), 41-50 years old (15.2%), and 51 years old and above (22.9%). Only 5.5% of respondents reported having less than high school education. The rest completed high school (33.4%), had some college (37.7%), or had college and post-graduate degrees (23.5%). About 56.6% of the sample were working, with 76.2% reporting a combined household income of over $10,000 annually. Forty-four percent (44.2%) of the respondents declared a yearly combined household income between $35,000 and more than $75,000. Most (84.4%) reported having medical insurance. Most were females (61.8%), and 62.6% of all respondents reported having at least 1 child (parents). Among the respondents without children (non-parents), 89.0% were 40 years or younger. Approximately half of the parents (48.5%) reported vaccinating their children against HPV.

Respondents' Knowledge

Table 2 summarizes respondents' knowledge of vaccines, HPV-related cancers, and the mode of transmission of the virus. Almost all parents (96.0%) and non-parents (97.2%) agreed that vaccines help prevent disease and that boys and girls should get the HPV vaccine (90.9% and 89.3%, respectively). However, nearly half of the sample indicated a lack of knowledge regarding the potential consequences of HPV infection. Surprisingly, only 15.7% of parents and 8.8% of non-parents associated HPV infection with oral cancer, while a large percentage incorrectly linked it to breast and lung cancer. Cervical cancer was the only cancer respondents correctly identified as linked to HPV.

Forty-nine percent (49.0%) of parents admitted they did not know how someone can get infected. A significantly smaller

Table 1. Participant Demographics Human Papilloma Virus Study, Guam 2017.

Characteristic	Parents (N=478) %	Non-Parents (N=285) %	Total (N=775) %	*P*-value[a]
Gender				
Male	34.5	44	37.6	<.001
Female	65.3	56	61.8	
LGBT	0.2	1.1	0.6	
Education Level				
Less than high school	8.2	1.1	5.5	<.001
High school or equivalent	38.4	24.7	33.4	
Some college	29.6	51.2	37.7	
4-year college or higher	23.7	33	23.5	
Age				
18-30	24.3	80.8	45.1	<.001
30-40	22	8.2	16.8	
41-50	22.8	2.8	15.2	
51 and above	31	8.2	22.9	
Ethnicity				
CHamoru	53.6	36.8	47.2	<.001
Filipino	19.9	36.5	26.1	
Other Micronesian	13.6	7.4	11.4	
Other	`3.0	19.3	15.3	
Occupation				
Employed	63.4	45.6	56.6	<.001
Unemployed	16.7	13.4	15.4	
Student	2.3	36.4	15	
Other	17.6	4.6	13	
Income				
$0 to $9,999	24.9	22	23.8	.53
$10,000 to $14,999	9.4	9.9	9.6	
$15,000 to $19,999	6.7	7.4	6.9	
$20,000 to $34,999	13.9	18.1	15.5	
$35,000 to $49,999	9	11.3	10	
$50,000 to $74,999	16.5	15.2	16	
$75,000 or more	19.5	16	18.2	
Medical Insurance				
Yes	89.3	76.2	84.4	<.001
No	10.7	23.8	15.6	
Child/Children had HPV Vaccination[a]				
Yes	48.5	N/A		
No	24.1	N/A		
Missing	27.4	N/A		

Note: Due to some missing values the sum of parents and non-parents is not equal to the total sample size.

LGBT - Lesbian, Gay, Bisexual, Transgender

[a] Chi-square test of independence.

Table 2. Knowledge of Human Papilloma Virus (HPV) among Guam Adults, 2017

Respondents who answered true or yes to the following:	Parents		Non-Parents		*P*-value[a]
Statement	**No.**	**%**	**No.**	**%**	
Vaccines can help to prevent disease	459	96	277	97.2	.4
Both boys and girls should get the HPV vaccine	427	89.3	259	90.9	.49
HPV infection can lead to:					
cervical cancer (True)	213	44.6	139	48.8	.26
penile cancer (True)	91	19	54	18.9	.98
oral cancer (True)	75	15.7	25	8.8	.006
breast cancer (False)	214	44.8	140	49.1	.24
anal cancer (True)	73	15.3	47	16.5	.66
genital warts (True)	92	19.2	77	27	.012
lung cancer (False)	149	31.2	95	33.3	.54
ovarian cancer (False)	222	46.4	147	51.6	.17
I do not know	234	49	130	45.6	.37
You are more likely to get infected with HPV by					
having more than 1 sexual partner (True)	180	37.7	128	44.9	.048
not using a condom (True)	153	32	125	43.9	<.001
having a family history of cancer (True)	121	25.3	87	30.5	.118
having sexual intercourse before the age of 18 years old (True)	98	20.5	71	24.9	.156
having given birth to 1 or more children (True)	28	5.9	22	7.7	.32
kissing (False)	230	48.1	154	54	.114
using public toilets (False)	231	48.3	160	56.1	.037
I do not know	197	41.2	101	35.4	.114

[a] Chi-square test of independence.

percentage of parents, compared to non-parents, understood that having multiple sexual partners (37.7% vs. 44.9%) and not using a condom during sexual intercourse (32.0% vs. 43.9%) can result in HPV infection.

Respondents' Attitudes, Beliefs, and Barriers

Table 3 summarizes the psychological constructs of the respondents. Results showed that respondents have a positive attitude towards vaccination. Most parents (98.7%) and non-parents (98.2%) answered that it is important that children get vaccines and few believe that drug companies are pushing HPV vaccination to make money (21.9% and 20.2%, respectively). Nearly half of the parents (49.1%) expressed concerns about

Table 3. Results of Psychological Construct Analysis about Human Papilloma Virus (HPV) Vaccination among Guam Adults, 2017

Respondents who answered true or yes to the following:	Parents		Non-Parents		*P*-value[a]
Attitude or norm	**No.**	**%**	**No.**	**%**	
Attitudes toward vaccine					
It is important that children get vaccines	470	98.7	280	98.2	.58
It is better to treat diseases naturally using home remedies	129	28.1	71	25.5	.45
HPV vaccine is being pushed to make money for drug companies	101	21.9	57	20.2	.58
If a teenager gets HPV vaccine, she or he may be more likely to have sex	110	23.7	74	26.3	.42
I am concerned about vaccine side effects	347	73.5	176	61.8	<.001
Subjective norms					
My religion is against vaccines	27	5.7	5	1.8	.009
My culture is against vaccines	25	5.3	3	1.1	.003
I will have my children get the HPV vaccine if the doctor tells me	409	88.9	N/A	N/A	N/A
Perceived Behavioral Control (PCB)					
I am concerned about the cost of the vaccine	231	49.1	135	47.4	.64
Transportation to get the vaccine is difficult for me and my family	96	20.6	27	9.5	<.001

[a] Chi-square test of independence.

cost, while 20.6% indicated difficulties with transportation to receive the vaccine. Culture and religious practices were not barriers to HPV vaccination. Most (73.5% of parents and 61.8% of non-parents) conveyed concerns about the side effects of the HPV vaccine, and some parents (23.7%) believe that if a child gets HPV vaccine, they may be more likely to have sex. Nevertheless, almost all (88.9%) indicated that if their doctor tells them to have their children get the HPV vaccine, they will do so.

One-way ANOVAs were conducted to compare the mean scores for attitude, knowledge and subjective norms, and perceived behavioral control across sex, ethnicity, education level, and income. Women had significantly higher mean scores than men in all 3 composite scores. Specifically, women demonstrated more favorable attitudes than men (M=3.68 vs M=3.35, $P<.001$); greater knowledge about HPV (M=7.07 vs. M=5.9, $P<.002$), and they scored higher in the social norm and perceived behavioral control (M=4.16 vs M=3.88, $P=.002$). Respondents with more than high school education, and higher incomes had significantly higher mean scores in all 3 variables ($P<.01$). Significant differences among ethnic groups were identified; Micronesians had the lowest average score for all measures ($P<.001$). There were no significant differences between participants who had their children vaccinated (M=3.62) and those who did not (M=3.51).

Logistic regression was used to examine the association between each variable and parents' intention to vaccinate their children against HPV (**Table 4**). The socio-demographic variables (sex, ethnicity, education) were initially entered into step 1 and were not significantly associated with intention to get the HPV vaccine for their children, (5) =4.97, $P=.42$. Step 2 included attitude, knowledge, subjective norms and perceived behavioral control variables. Only subjective norms and perceived behavioral control was significant factor affecting the willingness to get the HPV vaccine for their children. Respondents with more positive subjective norms and perceived behavioral control were over 7 times more likely to get their children vaccinated compared to less positive respondents (OR=7.024, $P<.001$).

Information Sources

Table 5 summarizes the information sources about HPV vaccine utilized by the respondents vis-à-vis their educational attainment and ethnicity were also examined. The numerical differences are as follows: All respondents chose health care providers as their primary source of information on HPV vaccination, but the degree varied by education level: less than high school education (42.9%), completed high school (56.6%), some college (60.1%) and a 4-year college degree (60.3 %) and post-graduate degrees (70.7%). Respondents with more education chose media as their secondary source of information: some college (34.6%), 4-year college degrees (36.9%), and post-graduate degrees (41.4%). While those with high school (32.4%) or less (31.0%) reported family and friends as their secondary source of information. Some participants responded that no one told them about HPV and HPV vaccination. This was further analyzed by educational attainment: less high school (16.7%), high school (14.8%), some college (10.4%), completed 4-year college degree (10.7%), post-graduate degrees (3.4%), and ethnicity. Higher numbers of CHamorus (13.7%) and Micronesians (19.3%) reported no one told them about HPV vaccination, while only 6.4% of Filipino participants responded they were not informed.

Discussion

This study aimed to provide insights into the factors influencing HPV vaccination intake in Guam. The team found that the level of knowledge was low, but the attitude was highly positive, and beliefs favored HPV vaccination. There were no significant differences in the knowledge, attitudes, and beliefs between parents and non-parents. Several factors played significant roles in HPV uptake.

Many did not understand how HPV is transmitted, its risks on those infected, and purpose of the HPV vaccine. Misconceptions

Table 4. Sex, Ethnicity, Education, Subjective Norms and Perceived Behavioral Control, Attitudes and Knowledge and the Intention to Get HPV Vaccine for Children[a]

Variable	Step 1			Step 2		
	P-value	OR	95% CI	*P*-value	OR	95% CI
Sex						
Male (ref)	.42	1		.84	1	
Female		1.29	(0.69, 2.42)		1.07	(0.54, 2.12)
Ethnicity						
CHamoru (ref)	.34	1		.112	1	
Filipino	.36	0.7	(0.33, 1.48)	.45	0.74	(0.33, 1.63)
Micronesian	.189	2.29	(0.67, 7.88)	**.036**	**3.98**	**(1.10, 14, 44)**
Other	.77	1.16	(0.441, 3.02)	.55	1.35	(0.50, 3.66)
Education						
HS or less (ref)	.83	1		.133		
more than HS		0.93	(0.49, 1.80)		0.57	(0.27, 1.19)
Subjective Norms and Perceived Behavioral Control[b]						
Less positive (Ref)					1	
More positive				**<.001**	**7.02**	**(3.32, 14.88)**
Attitude[b]						
Less positive (Ref)						
More positive				.47	0.77	(0.39, 1.55)
Knowledge						
Knowledge score				.61	0.98	(0.91, 1.06)

HPV=human papilloma virus, Ref+reference, HS-high school, OR=odds ratio
[a] Multinomial Logistic Regression Analysis among 485 parents
[b] Less positive means score <=3, more positive means score>3

Table 5. Source of Human Papilloma Virus (HPV) Vaccination Information among Guam Adults by Education and Ethnicity, 2017

Source of Information	Education Level					
	Less than HS %	High School %	Some College %	4 year degree %	Graduate degree %	*P*-value[a]
Health Care Provider	42.9	56.6	60.1	60.3	70.7	.076
Family	28.6	32.4	27.3	26.2	27.6	.67
Friends	31	19.1	18.3	24.6	17.2	.23
Media	28.6	26.2	34.6	36.9	41.4	.069
No one told me	16.7	14.8	10.4	10.7	3.4	.096
Source of Information	**Ethnicity**					
	CHamoru %	Filipino %	Other Micronesian %	*P*-value[a]		
Health Care Provider	59.6	68.3	40.9	<.001		
Family	30.5	28.2	26.1	.84		
Friends	20.3	18.8	28.4	.177		
Media	30	37.6	29.5	.28		
No one told me	13.7	6.4	19.3	.007		

Note: Multiple Responses were permitted.
[a] Chi-square tests of independence.

about cancer and HPV may be due to a lack of health care and advertisement of the HPV vaccine. Almost half of the parents responded that they lacked the knowledge to vaccinate their children. Several studies identified a lack of information, baseline knowledge, and information on HPV and HPV vaccination as barriers to vaccination uptake.[14,19 21] Almost all expressed that boys and girls should receive the vaccine. A 2007 study found that parents with positive attitudes toward vaccines were significantly more likely to have their daughters receive HPV vaccination.[16] But only half the parents in this study had their children vaccinated for HPV despite positive attitudes. There was a considerable gap between positive attitudes and desired behavior. Several parents might have had their children start the HPV vaccine but did not complete the series. A recent study in the US found that participants identified the multi-dose series as inconvenient and a barrier to HPV vaccination.[22] Completion of the HPV vaccination series could be affected by the parent's attitude or lack of access to health care.

Previous research in US and Canada [21,23] showed that educational attainment, knowledge level, and socioeconomic status did not predict HPV uptake. This study found similar results. Though not considered direct predictors of HPV vaccination uptake, education, income, and being female were significantly associated with knowledge, attitude, and beliefs. Those with higher income and more than a high school education had significantly higher mean scores in all 3 constructs. Women significantly scored higher than men. These results aligned with the National Health Interview Survey, which found that female parents with more education and higher income were likelier to have heard of HPV vaccines influencing the vaccine's receipt.[23] Greater parental intention has been associated with more knowledge of HPV and the vaccine.[16] In Guam, most of the cultural groups are historically matriarchal systems. Female family members, specifically mothers, often hold primary responsibility for health decisions,[21] particularly about their daughters' sexual health, and could be targeted when they present themselves to their providers during cervical cancer screening.[24]

Similar studies associated having health insurance coverage with HPV vaccination.[19, 25-26] Even though 81.4% of the study respondents reported having health insurance, HPV uptake was only 48%. Although most respondents had insurance, they identified cost as a barrier to HPV vaccination. This is supported by a previous study about parents who refused the HPV vaccination.[27] Further investigation must be done to identify other factors that prevented parents from having their children receive the HPV vaccine.

Previous studies found that ethnic and cultural factors were associated with HPV-related disease burden.[14,26] However, this study found that culture and religion were not reported to be barriers to vaccination.

Clinical Implication

All respondents chose health care providers and private clinics as their primary sources of HPV vaccination information. This highlights the role of the Guam health care system to increase knowledge, remove misconceptions, and expand awareness of HPV, its dangers to health, and its role in developing several cancers. This is consistent with Somera et al's[24] finding that health providers were viewed as the most trusted source of health and cancer information.

Special consideration should be given with Micronesians as they had the highest percentage among ethnic groups to assert that "*no one told them about HPV and the HPV vaccine."* Although 76.5% of Micronesians had insurance, they were unlikely to have their children receive the HPV vaccine. A study in Hawai'i found that Chuukese experienced barriers to health care, such as a lack of communication and confusion about the healthcare system.[28] Providers need efficient communication strategies to convey the need for the vaccine, provide information on the side effects while emphasizing the safety results, and underline the importance of timeliness.

Private clinics and the Department of Public Health and Social Services (DPHSS) must strengthen efforts to raise awareness of programs offering free HPV vaccinations. Almost all participants responded that they would have their children vaccinated if the doctor told them to do so. This greatly emphasized the role of health care providers in Guam, specifically physicians, in improving vaccination uptake.[24] This is supported by the National Immunization Survey (NIS)-Teen Immunization Survey (2018)[29] that showed Guam had a 14.3 percentage point vaccination coverage difference between those who received provider recommendations for HPV vaccination (73.6%) and those who did not (59.2%).

Future Direction

A significant gap exists between parents' positive attitudes towards HPV vaccination and actual vaccine receipt. This study relied on self-reports of parents who stated their child had been vaccinated. According to previous studies, parents who received counseling from their child's physician were more than twice as likely to accept the HPV vaccine at a later visit.[30-31] The team recommends a study of parents who had their children complete the HPV vaccine series to understand the factors influencing their decision.

Limitations

This was a cross-sectional study utilizing convenience, non-randomized sampling. Convenience sampling was utilized by attending outreach events, which may have gathered data from

individuals with positive health-seeking behaviors. Additionally, data was collected in 2017, and knowledge, attitudes, and practices may have evolved since then. Non-English speakers could not participate due to a lack of survey translation. This sample was more educated than the general population. Most (94.5%) participants have completed high school and more, while only 86.0% of Guam's population have completed high school or higher.[15] Another limitation is that the completion of the HPV vaccine series was not ascertained. Many who started the vaccination series did not complete the required doses or did not come back at the specified timeline of the succeeding dose. The survey tool was modified based on a tested tool but not tested for validity and reliability.

Conclusion

The results provide additional insights into the factors influencing parents' knowledge, attitudes, and intent to get the HPV vaccine for their children. They also highlight the significance of the physician's influence on parental decisions about HPV vaccination. Finally, these results can guide the implementation of effective strategies for developing targeted behavioral interventions and to develop appropriate approaches to increase the HPV vaccination uptake on Guam.

Conflict of Interest

None of the authors identify a conflict of interest.

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