


HPV Vaccine Beliefs and Correlates of Uptake Among Hispanic Women and Their Children on the US-Mexico Border

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Abstract

Introduction: Human Papilloma Virus (HPV) is the most common sexually transmitted infection nationally. Although preventable, uptake of the HPV vaccine is low. The purpose of this study was to describe HPV vaccine knowledge and beliefs and psychosocial correlates of vaccine uptake among adult females and their children in a US-Mexico border community.

Materials and Methods: We conducted a survey of uninsured women aged 21-65 years living in Texas who were due for cervical cancer screening. We utilized descriptive statistics to report demographic and psychosocial variables. We used logistic regression analysis to identify correlates of prior vaccine uptake.

Results: 599 women completed surveys: mean age was 44.69 years, 97.8%, were Hispanic and 86% were Spanish speaking; 5% had been vaccinated. Awareness of HPV infection & HPV vaccine was 81.6% & 68.6% respectively. Scores for mean perceived susceptibility was low and mean perceived benefits was high; the mean score for knowledge was 3.69 out of 6. Common parental barriers to child vaccination were cost, lack of accessibility and lack of information. Correlates of past HPV vaccine uptake among adult women were younger age, monthly income of \$2,500-\$5,000, full-time employment, US birth, and higher perceived severity of HPV. Older age was a correlate of vaccine uptake for daughters.

Discussion and Conclusion: Findings revealed low HPV vaccine uptake among adult Hispanic women, but high vaccine acceptability for their sons and daughters. Culturally tailored educational interventions are needed to improve HPV knowledge and HPV vaccine uptake among adults and their children.

Keywords

HPV, HPV vaccine, Hispanic, HPV vaccine uptake, vaccine acceptability

Introduction

Cervical cancer incidence and mortality has decreased over the last 60 years in the US largely because of the development of the Papanicolaou test.¹ A health disparity does exist however among Hispanic women, who have a 60% higher incidence of cervical cancer as compared to other ethnic groups.^{2,3} El Paso County, a predominantly Hispanic county (82% of the population) located along the Texas-Mexico border has an incidence rate of 8.9 per 100,000, with 10.7 per 100,000 for just Hispanics, compared to 7.4 per 100,000 nationally.^{4,5}

Human Papilloma Virus (HPV) is the most common sexually transmitted infection nationally, with a prevalence rate of

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42.5% among adults aged 18-59.⁶ Two high-risk HPV strains, 16 and 18, are responsible for 70% of cervical cancer cases.⁷ HPV infection is preventable and the HPV vaccine has been recommended since 2006.⁸ Currently the Advisory Committee on Immunization Practices recommends the HPV vaccination for children aged 11 or 12 years, but can be given starting at 9 years, prior to exposure to HPV.^{9,10} For individuals not previously vaccinated, it is recommended through age 26 and has recently been recommended for those up to 45 years old with shared decision making.^{9,10} Although the benefit of the vaccine is reduced at an older age because the individual has likely been exposed to HPV, it can potentially prevent risk of new infections.^{9,10}

Despite the Centers for Disease Control and Prevention (CDC) recommendation, HPV vaccine uptake is low nationally. As of 2017, HPV vaccination completion was 48.6% among all adolescents 13-17 years old¹¹ and 56.4% among Hispanic adolescents.¹² Barriers to vaccination include adverse effects of vaccination, lack of knowledge about HPV, low perceived need, cost, perception that the vaccine promotes sexual activity, and lack of access to healthcare.^{8,13} Interestingly, several studies have shown that despite these barriers, parental vaccine acceptability is quite high and this is more apparent for daughters than for sons.¹⁴

The primary motivation for parental vaccine acceptance included prevention of cervical cancer, a family history of cervical cancer, and to protect one's family and one's ability to care for the family.^{15,16} One of the positive predictors of being vaccinated is knowledge.¹⁷ HPV knowledge is higher among women who are married, have a higher educational level, are sexually active, have multiple sexual partners, have HPV, are HIV positive, and are younger.^{14,17,18} In the Gerend and Shepherd study,¹⁹ among primarily non-Hispanic White women, they found perceived susceptibility to be significantly associated with HPV vaccine uptake, but not perceived severity or perceived benefits. Gerend has conducted other studies exploring the beliefs and attitudes of Latinas^{2,8,18-20}; however, those studies have mostly focused on knowledge and overall beliefs, not as constructs grounded in theory. Furthermore, studies published on correlates of vaccine uptake have not looked at how it affects the vaccination uptake for their children, whether a daughter or son.

We wanted to explore knowledge and psychosocial variables and their impact on vaccine uptake among age-eligible Hispanic women and to take a deeper look and assess acceptability and barriers related to those women vaccinating their children who were age-eligible stratified by gender. Therefore, the purpose of this study was to describe HPV vaccine knowledge and psychosocial variables related to the Health Belief Model, vaccine uptake and correlates of previous vaccine uptake among a sample of Hispanic women and their children along the US-Mexico border. The primary outcomes were HPV knowledge, perceived susceptibility and perceived severity of HPV infection, and the secondary outcomes were vaccine uptake and associated predictors, including perceived benefits and perceived barriers.

Methods

Study Design and Setting

This cross-sectional study is an analysis of HPV survey data collected as part of a larger survey among participants of a cervical cancer screening program (De Casa en Casa: Preventing Cervical Cancer in El Paso and Hudspeth County, or De Casa en Casa) in two Texas counties between June 2014 and July 2017. The survey was grounded in the Health Belief Model.²¹ The program consisted of bilingual, culturally tailored education, no-cost pap testing and navigation support. Participants were recruited from 37 approved sites including food pantries, learning centers, non-profit organizations, community centers, local churches, as well as local clinics located in El Paso and Hudspeth Counties. The population in both counties is primarily Hispanic, of low socioeconomic status, lower educational attainment,^{7,22,23} and approximately one third is uninsured.²⁴ Ethical approval was obtained from the Institutional Review Board (IRB) of Texas Tech University Health Sciences Center El Paso.

Eligibility Criteria

Women were included in the study if they qualified for the De Casa en Casa program: i.e. were aged between 21 and 65 years old, reported a Texas address, were uninsured and were due for cervical cancer screening. Women who had a history of cervical cancer or had a hysterectomy were excluded from the study. As an embedded survey to our existing cervical cancer screening program, we only recruited women who currently fit the U.S. Preventive Services Task Force guidelines to receive a Pap smear and/or HPV test.²⁵

Recruitment

Participants were approached by program community health workers, or *promotores*. A sample of participants were offered participation in the survey portion of the study, if they agreed consent was obtained, and the survey was administered in-person by the *promotores* prior to the educational session to determine the baseline knowledge and beliefs about HPV infection and the HPV vaccine.

Measures

The survey items included demographic items covering age, educational attainment, income, ethnicity, marital status, length of time in the US, marital status, work status, birth country, language preference, health status, and number of sons and daughters and their ages (See Supplementary File). HPV knowledge was assessed with 6 true/false items that had previously been used in a study among a racially diverse population.¹⁸ Scores were calculated with each correct response equating to one point for a maximum score of 6.

Variables from the Health Belief Model, for which internal consistency was analyzed, included: perceived susceptibility of HPV infection (2 items), perceived severity of HPV

infection (4 items), HPV vaccine perceived barriers (5 items), HPV vaccine perceived benefits (3 items), and parental barriers to HPV vaccine (9 items). Scores for perceived susceptibility were measured with a 5-point scale from 1 = very unlikely to 5 = very likely. Perceived severity and perceived benefits to the vaccine were measured with a 6-point Likert-type scale from 1 = strongly disagree to 6 = strongly agree. These items were taken from a study that demonstrated a strong internal consistency and reliability for the scales ($\alpha = 0.86-0.94$).²¹ Perceived barriers to HPV vaccine used a 4-point scale from 1 = strongly disagree to 4 = strongly agree. One barrier item was measured with a 6-point scale from 1 = not at all to 6 = very much. HPV awareness (1 item), HPV vaccine awareness (1 item), HPV vaccine behavior (1 item), HPV vaccine intention (1 item), and parental acceptability to HPV vaccine (3 items) were also measured as a part of the survey. Consistent with accepted practice, many items were adapted from previous surveys.^{2,8,17,18,26-29}

The survey included several skip patterns based on responses to specific items, resulting in different sample sizes for variables. Parental acceptability and parental barriers were elicited with the same wording, but the son items were added half way through the project. Items for parental acceptability were adapted from Gerend et al.²⁰

Analysis

In a previous study,¹⁸ the HPV awareness was reported to be 78% with mean knowledge score of 3.5 (SD = 2.1) and 65% of the participants had an interest in receiving the HPV vaccine. Perceived risk had a mean of 2.29 (SD = 1.33) and 44% of participants reported being at-risk for HPV infection. Assuming similar distributions of HPV vaccine beliefs in our study population with 5% absolute deviation in prevalence estimates, a sample size of 400 participants was sufficient to produce a 2-sided 95% confidence interval with a width equal to 10% using a binomial distribution. We used the sample population who completed the baseline survey for the De Casa en Casa program, which was estimated to be 600. This sample size was more than sufficient to estimate the 95% CI for means of HPV knowledge and perceived susceptibility with 15% distance from means using normal distribution.

Participant demographics and scores for psychosocial variables were reported as descriptive statistics. Internal consistency was calculated for all psychosocial variables. The primary aim was to estimate HPV knowledge, perceived susceptibility and perceived severity of HPV infection, and the secondary aim was to estimate perceived benefits, perceived barriers, and predictors of vaccine uptake. The prevalence of HPV knowledge, perceived susceptibility and perceived severity of HPV infection were estimated and reported along with the 95% CI using a binomial distribution. Logistic regression analysis of covariates for vaccine uptake by adult female and their daughter(s) was conducted using Stata statistical software version 15.1.³⁰

Results

Demographics

Of the 1,002 eligible women approached to participate, 600 surveys were completed for a response rate of 59.9%, however one was excluded as it was a duplicate leaving a final sample size of 599. Table 1 shows the demographic characteristics of the study participants. The preferred language for most of the participants was Spanish (n = 515, 86.0%). The mean age was 44.69 years old (SD = 10.54). The majority of the study population were Hispanic (97.8%; n = 586), were born in Mexico (79.1%, n = 474), had lived in the US for more than 15 years (53.4%; n = 320), were married or living with a partner (58.4%, n = 350), had completed high school (58.6%, n = 351), and were unemployed (61.1%, n = 366). Household income varied, with the majority reporting a monthly household income of less than \$2,500 (76.3%, n = 354). With regard to health care, 91.4% (n = 435) of the participants did not have a regular physician and 57.7% (n = 345) of the participants reported their health status as good to excellent. Over half of the participants had at least one daughter less than 26 years old (59.1%, n = 354). Three hundred participants were asked about a son due to those questions being added half way through the study, and 58.7% (n = 176) reported having at least one son under 26 years old.

HPV Vaccination

Of our 599 participants who were age-eligible to receive the HPV vaccine in 2006, 13.1% (n = 16/122) had been vaccinated. Of the entire sample, 5% (n = 30/599) had received the vaccination. Of the 354 women with a daughter younger than 26 years old, 352 women completed the sections related to parents vaccinating their children, and about 51% (n = 179) had vaccinated their daughter. Of the 176 participants reporting they had a son younger than 26 years old, 175 completed sections related to parents vaccinating their children, and of these, 42.3% (n = 74) had vaccinated their son.

Although actual uptake of the HPV vaccine was low, intention to vaccinate themselves and parental acceptability to vaccinate their daughters and/or sons was high among the participants: 89.3% (n = 508/599; 95%CI: 86.4%-91.7%) reported that they would get vaccinated if their doctor recommended the HPV vaccine, 83.4% (n = 146/175 who responded with daughters under 26 years old) reported they would have their daughter vaccinated, and 91.8% (n = 90/98 who responded with sons under 26 years old) would have their son vaccinated.

Knowledge

With regard to HPV awareness, 81.6% (n = 489, 95%CI: 0.783-0.847) of the participants had heard about the HPV infection, whereas only 68.6% (n = 411, 95%CI: 64.7%-72.3%) of participants had heard about the HPV vaccine. The mean knowledge score was 3.69 out of 6 (n = 489) and 64.0% (n

Table 1. Demographic Characteristics of the Participants.

Variable	Total (N)	Frequency (n)	Percent (%)
Age			
Mean: 44.69 (SD = 10.54)			
21-30 years	599	69	11.5
31-40 years		145	24.2
41-50 years		188	31.4
>50 years		197	32.9
Ethnicity			
Hispanic	599	586	97.8
Non-Hispanic		13	2.2
Education			
<High school	599	248	41.4
≥High school		351	58.6
Monthly Household Income			
<\$2,500	464	354	76.3
≥\$2,500		110	23.7
Marital status			
Married/living with a partner	599	350	58.4
Not married/not living with a partner		249	41.6
Working status			
Not working	599	366	61.1
Part-time		176	29.4
Full-time		57	9.5
Country of Birth			
US	599	120	20.1
Mexico		474	79.1
Other		5	0.8
Years in US			
<15 years	599	279	46.6
≥15 years		320	53.4
Regular doctor			
Yes	476	41	8.6
No		435	91.4
Health Status			
Excellent/Very Good/Good	598	345	57.7
Fair/Poor		253	42.3
Preferred language			
English	599	60	10.0
Spanish		515	86.0
Both		24	4.0
Women with Daughter <26 years	599	354	59.1
Women with Son <26 years	300	176	58.7

= 313) received a score of 4 out of 6 or higher. The lowest knowledge score was on the item, "Most types of HPV cannot clear up on their own," with only 22.1% (n = 108) of participants responding with false, the correct answer. In addition, only 38.9% (n = 190) of the participants were aware that a person usually has no symptoms when infected with HPV.

Psychosocial Variables

Perceived susceptibility and perceived severity of HPV infection. The mean score for perceived susceptibility was 4.14 out of 10 (n = 599; $\alpha = 0.93$). Out of the 599 participants, 15.5% (n = 93; 95%CI: 12.7%-18.7%) believed that they were likely to get

Table 2. HPV Knowledge and Beliefs.

Variable	Total (N)	Mean	SD	Median	Score range
HPV knowledge	489	3.69	1.360	4.0	0-6
Perceived Susceptibility	599	4.14	2.397	4.0	2-10
Perceived Severity	599	16.59	4.947	18.0	4-24
Perceived Barriers	22	10.59	3.487	11.0	5-20
Perceived Benefits	22	14.23	3.841	15.0	3-18

HPV in the future and 13.7% (n = 82; 95%CI: 11.04%-16.7%) reported they were likely to get a genital HPV infection within the next 10 years.

For perceived severity to the infection, the mean score was 16.59 out of 24 (n = 599; $\alpha = 0.79$). The 3 items participants most agreed with were that having HPV would be disruptive to their physical health (86.6%, 95%CI: 83.7%-89.3%, n = 519), to their romantic relationships (80.5%, 95%CI: 77.1%-83.6%, n = 482), and to their life overall (75.5%, 95%CI: 71.8%-78.9%, n = 452).

Perceived barriers and perceived benefits. Only participants between age 21 to 26 years old responded to items related to perceived barriers and perceived benefits of the HPV vaccine (n = 22/599). The mean score for perceived barriers was 10.59 out of 20 (n = 22; $\alpha = 0.62$). The barriers most frequently reported included lack of information about the vaccine itself (36.4%, n = 8), lack of information about where to get the vaccine (63.6%, n = 14), and cost (36.4%, n = 8). The mean scores for perceived benefits of the HPV vaccine were higher, with a mean of 14.23 out of 18 (n = 22; $\alpha = 0.87$). The majority of 21 to 26 year old participants believed that the HPV vaccine would help them stay healthier (86.4%, n = 19/22), potential benefits of the vaccine outweigh the potential risks (72.3%, n = 16), and getting the vaccine would be good for their health (90.9%, n = 20) (see Table 2).

Participants with vaccine-eligible daughters who had not been previously vaccinated (n = 147) or vaccine-eligible sons who had not been previously vaccinated (n = 89) were asked to identify barriers to vaccination for their children ($\alpha = 0.68$ combined for both daughters and sons). The most frequent barriers identified by the participants were similar for both those with daughters and sons, with over half of the respondents reporting the most common barriers as: cost, accessibility of the vaccine, and lack of adequate information about the vaccine (see Table 3).

Correlates of Past HPV Vaccine Uptake

Logistic regression was conducted to assess the correlates of prior HPV vaccine uptake for women who would have been eligible to be vaccinated in 2006 (122 were eligible in 2006, 118 of these had complete data and were included; see Table 4). Significant factors that emerged for women being more likely to be vaccinated included: 21-30 years old (p = .014), monthly

Table 3. Parental Barriers to HPV Vaccine for Daughters (n = 147) and for Sons (n = 89).

Item	n (%) Agree/strongly agree for daughter(s)	n (%) Agree/strongly agree for son(s)
I need more information to make a decision.	96 (65.3%)	49 (55.1%)
I do not know where to go to get the vaccine.	82 (55.8%)	50 (56.2%)
I think HPV vaccine may cause health problems in the future. (Side effects)	17 (11.6%)	12 (13.5%)
I believe my child may think it is okay to have sex after getting the HPV Vaccine.	36 (24.5%)	22 (24.7%)
I would vaccinate my child with the HPV vaccine if it were free or at very low cost.	121 (82.3%)	79 (88.8%)
I would vaccinate my child with the HPV vaccine if she could get it at school.	111 (75.5%)	74 (83.2%)
Shots are very painful for my child, so I would rather not vaccinate her.	18 (12.2%)	7 (7.9%)
If the new HPV vaccine is not required, I will not vaccinate my child.	42 (28.6%)	24 (27.0%)
I think that even if the vaccine is expensive, I will be able to vaccinate my child.	107 (72.8%)	69 (77.5%)

income of greater than or equal to \$2,500 ($p = .045$), being employed full time ($p = .091$), being born in the US ($p = .054$), and a higher perceived severity score ($p = 0.091$). Logistic regression analysis of covariates by vaccine uptake in sons did not reveal any significant association and this analysis is not included because of concerns about the small sample size.

Logistic regression was conducted to assess correlates of past HPV vaccine uptake for daughters among participants with age-eligible daughters (see Table 5). Only age, being older than 30 years old ($p \leq .002$), and education, having at least high school education ($p = .084$), were found to be significant among adult females in contributing to HPV vaccination of daughter(s): Women who had higher knowledge, higher perceived susceptibility and higher perceived severity of HPV infection indicated a tendency to be less likely to vaccinate their daughters.

Discussion

This study is the first to our knowledge that provides theory-based investigation of HPV vaccine uptake, acceptability and correlates of vaccine uptake among primarily Hispanic women. Our study sample is representative of El Paso and Hudspeth Counties where less than a quarter of the population have a Bachelor's degree or higher (22.8% and 6.9%, respectively), median annual household income is less than \$45,000 (\$44,597 and \$29,318, respectively), and about a quarter of the population is without health insurance (23.8% and 28.3%, respectively).^{22,23}

The preferred language for most of the participants was Spanish ($n = 515$, 86.0%). The mean age was 44.69 years old ($SD = 10.54$). The majority of the study population were Hispanic (97.8%; $n = 586$), were born in Mexico (79.1%, $n = 474$), had lived in the US for more than 15 years (53.4%; $n = 320$), were married or living with a partner (58.4%, $n = 350$), had completed high school (58.6%, $n = 351$), and were unemployed (61.1%, $n = 366$). Household income varied, with the majority reporting a monthly household income of less than \$2,500 (76.3%, $n = 354$). With regard to health care, 91.4% ($n = 435$) of the participants did not have a regular physician and 57.7% ($n = 345$) of the participants reported their health status as good to excellent.

Overall 13.1% of those age-eligible when the vaccine became available had received it and 5% of all participants had

received the HPV vaccine. This is much lower than the current national rate for all races (48.6%)^{11,12}; however, 91% of our study population reported having no regular health care provider thereby not having a medical home where they would have vaccinations recommended to them that are not required by the state, as in Texas. In addition, the HPV vaccine coverage rate was lower in 2008 at about 38%, shortly after the launching of the HPV vaccine.³¹

Among age-eligible daughters of respondents about 51% had been vaccinated, which is on par with the national rate of Hispanic adolescents at 56.4%.^{11,12} However, vaccination among age-eligible sons was lower at 42%. Baseline knowledge of HPV and the vaccine was quite high among respondents, while perceived susceptibility and severity scores were low. Furthermore, our findings indicate that age, income, employment status, country of birth, and perceived severity are associated with previous HPV vaccination of Hispanic women in our study. Only respondent age and education were associated with previous HPV vaccination of daughters.

Even though the vaccine uptake rate among our sample was low, parental acceptability and intention to vaccinate was high, which is consistent with the existing literature. Over 3-quarters of our participants reported planning to vaccinate their daughters (83% of 175 women who responded with daughters under 26 years old) and the majority (92% of 98 women who responded with sons under 26 years old) reported planning to vaccinate their son. This is similar to findings from Sanderson and colleagues,¹⁴ who conducted a cross sectional study along the US-Mexico border and found that more than 90% of the Hispanic population intended to vaccinate their children against HPV. Other studies on the HPV vaccine also corroborate these findings and show that Hispanic mothers are more likely than non-Hispanic White mothers to express willingness to vaccinate their children.¹⁶

Overall, the majority of respondents had heard about the HPV infection (82%), which is more than in an earlier study in the same region completed between 2007 and 2009 (62%) but similar to a more recent study in the same region.^{26,28} Awareness appears to have plateaued over time, suggesting that ongoing health campaigns and educational interventions are needed to further improve awareness about the HPV vaccine.

Table 4. Logistic Regression Analysis of Covariates of Vaccine Uptake by Vaccine-Eligible Females in 2006 (n = 118)*.

Characteristics	OR	95% CI	p-value
Age (n = 118)			
21-30 years	Reference		
31-40 years	0.818	.111-.604	0.014
Ethnicity (n = 118)			
Non-Hispanic	Reference		
Hispanic/Latino	0.664	.107-4.109	0.659
Education (n = 118)			
<High school	Reference		
≥High school	3.438	.475-24.870	0.221
Monthly Household Income (n = 118)**			
<\$2,500	Reference		
≥\$2,500	2.753	1.022-7.417	0.045
Marital status (n = 118)			
Not married/not living with a partner	Reference		
Married/living with partner	1.065	.413-2.743	0.896
Working status (n = 118)			
Not working	Reference		
Part-time	0.951	.276-3.272	0.936
Full time	2.444	.868-6.884	0.091
Country of Birth (n = 118)			
US	Reference		
Mexico	0.394	.153-1.014	0.054
Years in US (n = 118)			
≤15 years	Reference		
>15 years	1.313	.527-3.276	0.558
Health Status (n = 118)			
Fair/Poor	Reference		
Excellent/Very Good/Good	4.013	.951-16.930	0.058
Preferred language (n = 118)			
English	Reference		
Spanish	0.518	.171-1.570	0.245
Both	2.000	.610-6.55	0.252
Knowledge Score (n = 118)			
Lower score (0-4)	Reference		
Higher score (5-6)	0.863	.291-2.556	0.790
Perceived Susceptibility score (n = 118)			
Lower score (2-4)	Reference		
Higher score (5-10)	0.875	.339-2.256	0.782
Perceived Severity Score (n = 118)			
Lower score (4-18)	Reference		
Higher score (19-24)	2.267	.878-5.849	0.091

NOTES: Lower and higher score cutoffs based on median score; Removed Don't Know/Refused responses; Data for Regular Doctor not provided because all responses were "No."

* = 122 were eligible in 2006, 118 of these had complete data and were included.

**= Data for monthly household income >\$5,000 was not included because there were only 11 responses.

Primary Outcomes

With regard to knowledge, about two thirds of the participants responded correctly to 4 or more of the 6 items. This was quite different from what has been found in another study, among mostly non-Hispanic Whites, where participants displayed only

Table 5. Logistic Regression Analysis of Covariates of Vaccine Uptake in Daughters by Adult Female (n = 326).

Characteristics	OR	95% CI	p-value
Age (n = 326)			
21-30 years	Reference		
31-40 years	3.852	1.695-8.753	0.001
41-50 years	3.725	1.640-8.459	0.002
≥ 51 years	3.800	1.654-8.728	0.002
Ethnicity (n = 326)			
Non-Hispanic	Reference		
Hispanic/Latino	1.659	.532-5.176	0.383
Education (n = 326)			
<High school	Reference		
≥High school	1.206	.975-1.490	0.084
Monthly Household Income (n = 326)			
<\$2,500	Reference		
≥\$2,500	0.985	.764-1.269	0.906
Marital status (n = 326)			
Not married/not living with a partner	Reference		
Married/living with partner	1.036	.839-1.279	0.744
Working status (n = 326)			
Not working	Reference		
Part-time	1.147	.925-1.423	0.211
Full time	1.164	.819-1.655	0.398
Country of Birth (n = 326)			
US	Reference		
Mexico	1.246	.930-1.669	0.140
Years in US (n = 326)			
≤15 years	Reference		
>15 years	1.154	.946-1.408	0.157
Regular doctor (n = 326)			
No	Reference		
Yes	1.229	.903-1.670	0.190
Health Status (n = 326)			
Fair/Poor	Reference		
Excellent/Very Good/Good	1.003	.821-1.225	0.977
Preferred language (n = 326)			
English	Reference		
Spanish	1.217	.778-1.904	0.390
Both	1.155	.618-2.159	0.651
Knowledge Score (n = 326)*			
Lower score (0-4)	Reference		
Higher score (5-6)	0.949	.761-1.183	0.640
Perceived Susceptibility score (n = 326)*			
Lower score (2-4)	Reference		
Higher score (5-10)	0.974	.797-1.191	0.800
Perceived Severity Score (n = 326)*			
Lower score (4-18)	Reference		
Higher score (19-24)	0.870	.711-1.066	0.180

NOTE: Removed Don't Know/Refused responses.

*Lower and higher score cutoffs based on median score.

minimal knowledge of the HPV infection and the average knowledge score of 5.5 out of 14.¹⁸ The most common misconception among current study participants was related to HPV's transient course and asymptomatic nature. Less than a third of the participants had knowledge about the transient

nature of the infection and just over a third had knowledge about the asymptomatic nature of the infection.

A common finding in the literature is that lower knowledge is associated with higher uptake of school-required vaccines.³² In our study, knowledge was not associated with vaccine uptake, although the overall knowledge score of our participants was quite high with 64.0% receiving a score of 4 out of 6 or higher. A study by Bahena et al³³ among Mexican-American women compared to Mexican women, found that most participants correctly responded to more than half of the knowledge items and an overwhelming majority of participants reported the HPV vaccine as safe and beneficial. Much like in our study, the Bahena et al³³ study demonstrates that lower knowledge does not always equate to higher vaccine acceptability and uptake.

In a study with mostly White female undergraduate students, which used identical perceived susceptibility and perceived severity items, found that perceived susceptibility of HPV infection but not perceived severity predicted intention of HPV vaccination uptake.³⁴ Our study found that higher perceived severity scores were borderline significantly associated with increased HPV vaccination uptake. This means that our participants more strongly agreed that having genital HPV would be disruptive to their social life, physical health, romantic relationships, and their life overall. From a practical standpoint, this finding is logical because we would expect that those who see HPV as more disruptive would be more likely to be vaccinated to prevent infection.

Secondary Outcomes

The most common barriers identified in our study included: lack of information about the actual vaccine, where to get vaccinated, and cost. Several of these barriers, namely cost and lack of information about the vaccine, have been found in various studies among diverse populations.^{13,17} Some barriers mentioned in other studies among both Hispanic and non-Hispanic Whites were not as common for our participants (e.g., moral concerns about effects on sexual behavior, safety and benefits of the vaccines, and denial of need).² Cost was mentioned by our participants as one of the main barriers to being vaccinated despite the availability of the HPV vaccine at no-cost from the Texas Vaccines for Children Program for adolescents 19 years of age or younger and the Adult Safety Net Program for those over 19 years old who are uninsured or underinsured.³⁵ This suggests that individuals are unaware of the programs because they are not accessing care, providers are not offering these programs, or individuals are ineligible for the programs for other reasons. Future strategies could focus on informing providers of adult primary care about the Adult Safety Net program in particular, in addition to educating the public about these programs and developing strategies to make the programs more widely available (e.g. through pharmacies) in order to improve access. A further factor that may lead to low priority for this vaccine among parents of adolescents is

that the HPV vaccine is not included in school entry requirements.

Results from the current study showed that younger age, a monthly income of \$2,500-\$5,000, working full-time, US birth, and having a higher perceived severity of developing cervical cancer are significant predictors of previous HPV vaccination. Other studies of mostly Hispanic adolescent girls and adult females found similar results with increased likelihood of HPV vaccination for those with health insurance, having a regular doctor, positive vaccine attitudes,²⁰ and vaccine as cancer prevention.²⁸ Although these studies assessed different factors, one factor in common was age – yet, there have been mixed results with some indicating either older or younger age to be associated with vaccine uptake. Our study did, however, find that older maternal age and higher education were significantly associated with vaccinating a daughter, which is surprising given that we had found those under 30 were more likely to themselves be vaccinated. Perhaps mothers over 30 years old are able to overcome the barriers of cost and have become more educated on the benefits of the vaccine. Over half of the women reporting having a daughter younger than 26 years old were at least 40 years old (62%; n = 220/354) and may therefore also be more economically stable. Although there is no specific data for the counties under study, the Henry J. Kaiser Family Foundation reported that minority high school students were more likely to report initiating sexual intercourse prior to 13 years old³⁶ and the 2009 National Survey of Latinos found that 77% of young adults 16 to 25 years old reported having sexual intercourse with more than a quarter of them reporting initiating sex before turning 16 years old (28%).³⁷ El Paso County does have a high teen pregnancy rate at 38.3 per 1,000 girls 15-19 years old compared to 20.3 in the U.S.³⁵ In 2016, there were over 1,200 births among girls 15-19 years old.³⁸ As a result, older women in El Paso County may have had their children at a younger age and want to ensure that their daughters are protected in the event they become sexually active during adolescence.

Limitations to this study include the varying sample size for each variable due to the multiple skip patterns in the survey. Also, because items related to having a son were only added half way through the study, this made analysis of predictors not feasible. Furthermore, the cross-sectional nature of the study prevented the establishment of causal relationship between demographic variables and vaccine uptake by the adult themselves and for their daughters and sons. Future studies should assess the impact of HPV education on vaccine uptake.

Conclusion

This study among screening eligible Hispanic women provides important information about their knowledge and attitudes toward HPV vaccination both for themselves and for their sons and daughters. The findings show that despite low uptake of HPV for themselves in the past, they have positive attitudes toward vaccination of their sons and daughters and their main barriers are related to logistics and cost. This suggests that

providers should especially focus on these barriers when counseling vaccine-eligible Hispanic women and Hispanic parents of vaccine-eligible children about HPV vaccination. Furthermore, future interventions should focus on innovative methods to enhance vaccine accessibility in a culturally sensitive manner so as to be most effective among Hispanic populations and those living along the US-Mexico border.

Authors' Note

The data that support the findings of this study are available from the corresponding author [JC-M] upon reasonable request. Our study was approved by Institutional Review Board (IRB) of Texas Tech University Health Sciences Center El Paso (approval number E17092). All participants provided written informed consent prior to enrollment in the study.


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Supplemental Material

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