



U.S. Vietnamese parents' HPV vaccine decision-making for their adolescents: an exploration of practice-, provider-, and patient-level influences

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Abstract U.S. Vietnamese have high cervical cancer incidence and low human papillomavirus (HPV) vaccine initiation. Using the P3 model, we explored practice-, provider-, and patient-level determinants of U.S. Vietnamese parents' HPV vaccine decision-making for their adolescents. We conducted a cross-sectional, online survey (04/2020–12/2020) with U.S. Vietnamese parents who had ≥ 1 adolescent ages 9–18. We assessed HPV vaccination outcomes (initiation, willingness to initiate, completion) and provider recommendation. Modified Poisson regressions were used to identify practice-, provider- and patient-level correlates of outcomes. The sample ($n=408$) was 44 years old on average; 83% were female and 85% had a Bachelor's degree. Around half of

adolescents were female (51%) and 13–18 year old (54%). Only 41 and 23% of parents had initiated and completed the HPV vaccine series for their child, respectively. Initiation was associated with receiving provider recommendation (either low- or high-quality), while willingness to initiate was associated with receiving high-quality recommendation. Both initiation and willingness to initiate was negatively associated with parental perception that their child was too young for a “sexually transmitted infection (STI)-preventing vaccine.” Provider recommendation was associated with higher parental U.S. acculturation and the child being older and female. Provider-facing interventions should promote high-quality, age-based, gender-neutral HPV vaccine recommendation. These and population- and individual-facing interventions should recognize the need for additional parental education, particularly related to misconceptions regarding STI prevention.

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Introduction

U.S. Vietnamese, defined as those living in the U.S. and identifying as Vietnamese, number more than 1.8 million as of 2019, representing the fourth largest Asian group in the U.S. (United States Census Bureau, 2019). Compared to other Asians in the U.S., U.S. Vietnamese have lower English proficiency, median household income, and educational attainment and are more likely to be uninsured and in poverty (United States Census Bureau, 2019). These disadvantages reflect potential barriers to health services utilization and highlight a need to study health behaviors and outcomes in this specific subgroup.

One important health disparity among this population is cervical cancer rates. Historically, U.S. Vietnamese had the highest cervical cancer rate among all racial and ethnic groups. From 1988 to 1992, the cervical cancer incidence rate (per 100,000) in U.S. Vietnamese was 43.0, compared to 7.5 in non-Hispanic Whites, 13.2 in Blacks, and 16.2 in Hispanic (Miller et al., 1996; Parker et al., 1998; Surveillance Epidemiology & End Results Program n.d.). The incidence rate has since decreased [possibly due to the implementation of several cervical cancer screening interventions in U.S. Vietnamese communities in the late 1990s and 2000s (Ma et al., 2015; Mock et al., 2007; Scoggins et al., 2010; Taylor et al., 2010) but still remains high. From 2009 to 2011, the cervical cancer incidence rate (per 100,000) was 9.0 in U.S. Vietnamese, versus 6.5 in all Asian Americans and 7.5 in non-Hispanic Whites (Jin et al., 2016). No published data examine periods that are more recent or look at other HPV-related cancers (e.g., cancers of the vulva, vagina, penis, anus, or oropharynx) among U.S. Vietnamese. As past research has noted, data on HPV-related cancers and other cancers for specific Asian subgroups (including U.S. Vietnamese) are scant due to the tendency to report aggregated instead of disaggregated statistics and the limited availability of data collection tools in Asian languages (Chen, 2005; Holland & Palaniappan, 2012; Islam et al., 2010; Lee et al., 2019a; Liu et al., 2019; Srinivasan & Guillermo, 2000; Thompson et al., 2016).

Evidence of high cervical cancer incidence rates points to the circulation of the virus in this population and necessitates solutions to reduce HPV-related cancer burden, particularly through increased HPV vaccine uptake. HPV vaccination is a safe and effective method to prevent HPV-related cancers, including cervical cancer. To date, limited research has focused on HPV vaccination among U.S. Vietnamese (Duong & Hopfer, 2020; Gor et al., 2011; Hopfer et al., 2017; Nguyen-Truong et al., 2017; Yi et al., 2013a, 2013b). Findings indicate that U.S. Vietnamese generally have low awareness or knowledge of the vaccine and low HPV vaccine uptake (Duong & Hopfer, 2020; Gor et al., 2011; Hopfer et al., 2017; Nguyen-Truong et al., 2017; Yi et al., 2013a, 2013b). For example, among 113 Vietnamese women in Houston-based survey, only 14% reported vaccine initiation (Yi et al., 2013a). Factors related to HPV vaccine intention or uptake among U.S. Vietnamese included English proficiency (Yi et al., 2013a), HPV vaccine knowledge (Yi et al., 2013a), vaccine recommendation from healthcare providers (Hopfer et al., 2017; Yi et al., 2013b), influences from family members (Hopfer et al., 2017; Nguyen-Truong et al., 2017), and school-based education (Hopfer et al., 2017; Nguyen-Truong et al., 2017).

This existing literature regarding HPV vaccination among U.S. Vietnamese has two major limitations. First, existing research has primarily focused on U.S.

Vietnamese young adult females (Duong & Hopfer, 2020; Gor et al., 2011; Hopfer et al., 2017; Nguyen-Truong et al., 2017; Yi et al., 2013a). Research including U.S. Vietnamese adolescents is limited to only one study assessing mothers' intention to get the HPV vaccine for their daughters (ages 9–26) (Yi et al., 2013b) and no publications have focused on adolescent boys or men. Given that the HPV vaccine is the most effective when administered to adolescents before the age of 15 (Centers for Disease Control & Prevention, 2020; Pedersen et al., 2007), is currently recommended for both sexes (Centers for Disease Control & Prevention, 2020), and most likely requires parental consent (Zimet, 2005), research examining U.S. Vietnamese parents' HPV vaccine uptake for both male and female adolescents is critically needed to estimate vaccination coverage and identify modifiable barriers to utilization.

Second, limited research has leveraged a comprehensive health services framework to examine factors at different health system levels influencing HPV vaccine uptake among U.S. Vietnamese. Rather, existing research has concentrated on individual-level factors (e.g., language, vaccine knowledge) (Duong & Hopfer, 2020; Gor et al., 2011; Hopfer et al., 2017; Nguyen-Truong et al., 2017; Yi et al., 2013a, 2013b) or only looked at a single healthcare system factor—provider recommendation. Research exploring a wide range of factors related to the healthcare environment in which caregivers or patients make decision is needed, particularly because healthcare system-based interventions effectively improve HPV vaccine coverage (Niccolai & Hansen, 2015; Smulian et al., 2016). One framework that is well-suited to address this specific health behavior and multilevel healthcare factors associated with it is the P3 model (Bednarczyk et al., 2018). The P3 model highlights the roles of practice-, provider-, and patient-level components in the healthcare encounter that influence preventive care behaviors (Bednarczyk et al., 2018) and has been used in previous research examining facilitators of or barriers to HPV vaccination (Vu et al., 2020a, 2020b).

Using the P3 model, we aimed to fill these gaps in the literature by examining U.S. Vietnamese parents' HPV vaccine decision-making for their adolescents of both sexes. Specifically, we examined factors that influence Vietnamese parents' HPV vaccine initiation for their adolescents across three levels: (1) *practice* (e.g., clinic-based availability of HPV vaccine materials, availability of interpreter or patient navigation services), (2) *provider* (e.g., provider recommendation quality), and (3) *patient* (e.g., predisposing, enabling, and reinforcing factors). In addition, we examined P3 factors associated with HPV vaccine completion among initiators and with willingness to initiate HPV vaccine among non-initiators, as well as sociodemographic factors associated with receiving a provider recommendation for the HPV vaccine.

Methods

Recruitment and data collection

The methods employed for the recruitment of this study have been described elsewhere (Vu et al., 2021). Briefly, from April to December 2020, we conducted an online, cross-sectional survey with 408 U.S. Vietnamese parents. We utilized several different venues for recruitment: community-based organizations (CBOs) serving Vietnamese and/or Asians (n = 60 CBOs), Vietnamese Students Associations (VSAs, n = 13 VSAs), relevant Facebook groups and listserv engaging U.S. Vietnamese (n = 12 and n = 2, respectively), the personal network of the first author, and snowball sampling among participants successfully recruited using the aforementioned channels (Sadler et al., 2010). We successfully recruited 68 participants from CBOs and VSAs, 97 from Facebook groups, 4 from listserv, 42 from the first author's network, and 197 from snowball sampling. The overall response rate was 72% (range: 52–87%), as calculated by the American Association for Public Opinion Research's (AAPOR) response rate calculator version 4.1 (American Association for Public Opinion Research, 2020).

Parental eligibility criteria included: (1) self-identified as Vietnamese; (2) having lived in the U.S. for at least 12 months; (3) able to read either Vietnamese or English; and (4) having at least one child ages 9–18 living in the same household. Only one parent per household was allowed to participate. Participants first completed an online eligibility screener (administered via SurveyGizmo). Those eligible were directed to a webpage with a study description and a consent form. Consenting individuals indicated consent via clicking “Yes, I confirm participation in this study” and were directed to the online survey (via SurveyGizmo). The survey took approximately 60 min to complete. We limited duplicate responses by permitting only one response per IP address. Participants were compensated with a \$30 Amazon gift card.

Measurements

Survey measures, informed by the literature (Vu et al., 2020a), were reviewed by the research team (i.e., experts in HPV vaccine, Vietnamese health, Asian health, and survey research). Participants could choose to take the screener and main survey in either Vietnamese or English. Survey translation was conducted using the Brislin's back-translation method (Brislin, 1970), an iterative translation process involving an independent translation of survey items into Vietnamese and back-translation into English by two different translators, and then reviewed by the first author (who is fully fluent in both languages) and by approximately 10 Vietnamese native speakers to ensure comprehensibility.

Participants were instructed to provide answers about only one child who was between 9 and 18 years old and lived in their home. Those with more than one child in this age range living in their home were instructed to answer these questions considering their oldest child in the age range. Appendix A lists all survey questions.

Outcomes: HPV vaccine initiation, completion, willingness to initiate, and provider recommendation

All outcome measures were adapted from the 2019 National Immunization Survey—Teen (Centers for Disease Control & Prevention, 2019). HPV vaccine initiation was assessed by asking, “Has your child ever received HPV vaccine shots?” To assess provider recommendation for HPV vaccine, we asked, “Has a doctor or other healthcare professional ever recommended that your child receive HPV vaccine shots?” (response options of yes, no, don't know). For both questions, responses were dichotomized (0 = no/don't know, 1 = yes).

Among those who indicated that they did not initiate the HPV vaccine for their child or did not know whether their child had initiated the HPV vaccine, willingness to initiate HPV vaccine was assessed by asking, “How likely is it that your child will receive HPV vaccine shots in the next 12 months?” Responses were dichotomized (0 = not at all/not very likely/prefer not to answer, 1 = somewhat/very likely). Among those who indicated their child had initiated the HPV vaccine, we asked, “How many HPV vaccine shots has your child received?” We also asked the age that the child received the first HPV vaccine shot. Per the CDC's Advisory Committee on Immunization Practice's (ACIP) recommendations (Centers for Disease Control & Prevention, 2020), HPV vaccine completion was defined as having received two doses if the child initiated the HPV vaccine before age 15 and three doses if initiated at 15 or older. Those who indicated they did not know how many vaccine shots their child received were treated as not having completed the series. In addition, we assessed reasons for initiating the HPV vaccine, reasons for not initiating, and reasons for initiating but not completing the vaccine series [adapting previously used measures (Vu et al., 2019a)].

Practice-level correlates

Newly-created items assessed healthcare practice-level factors relevant to HPV vaccine initiation, including if they had seen materials about the HPV vaccine at their child's primary clinic or had ever used clinic-based patient navigation or language translation/interpretation services (yes or no). Those without a primary clinic were treated as missing data.

Provider-level correlates

For those who had received a provider recommendation for the HPV vaccine, we assessed HPV vaccine recommendation quality by asking three questions reflecting different recommendation dimensions (Gilkey et al., 2016a): (1) “How important did the provider say the HPV vaccine was your child?” (response options of 1 = not at all to 4 = very important, reflecting “strength”); (2) “Did the healthcare provider tell you that the HPV vaccine prevents cancer?” (response options of 1 = strongly disagree to 4 = strongly agree, reflecting “prevention”); and (3) “Did the healthcare provider recommend that your child gets the vaccine that same day?” (response options of 1 = strongly disagree to 4 = strongly agree, reflecting “urgency”). Strength was dichotomized as 1 = very important versus 0 = other responses; prevention and urgency were dichotomized as 1 = agree/strongly agree versus 0 = other responses. We then calculated the summed score of the three items and created two categories: low-quality recommendation (scores of 0–1) and high-quality recommendation (scores of 2–3). Those who did not receive a provider recommendation were grouped into the third category of “no recommendation.”

Patient-level correlates

Guided by the P3 model, we included measurements of predisposing factors (i.e., individual characteristics, beliefs, and values that facilitate or hinder HPV vaccine uptake), enabling factors (i.e., skills, resources, or barriers that facilitate or hinder HPV vaccine uptake), and reinforcing factors (i.e., perceived rewards and feedback received from HPV vaccine uptake) (Bednarczyk et al., 2018; Green & Kreuter, 2005).

Regarding *predisposing factors*, we administered the Vaccine Confidence Scale (Gilkey et al., 2016b), which assesses parents’ level of general vaccine confidence (i.e., not HPV vaccine-specific) and includes subscales assessing perceived vaccine benefits, vaccine harms, and trust in medical professionals. Participants were asked to indicate their level of agreement (0 = strongly disagree to 10 = strongly agree) to eight statements (e.g., “Vaccines are safe” and “I have a good relationship with my teenager’s healthcare provider”). Two items were reverse-coded: “Teenagers receive too many vaccines” and “If I vaccinate my teenager, he/she may have serious side effects.” A higher score, derived as an average of item scores, indicates more positive attitudes towards vaccination (Cronbach’s alpha = 0.76 in this sample).

We adapted three items from the Carolina HPV Immunization Attitudes and Beliefs Scale (McRee et al., 2009) (CHIAS) to assess perceived effectiveness of HPV vaccine in preventing genital warts, cervical cancer, and HPV (1 = slightly effective to 5 = extremely effective). A higher score, derived as an average across items, indicates higher

perceived effectiveness of HPV vaccine in preventing diseases (Cronbach’s alpha = 0.83).

We used two CHIAS items to assess beliefs about the HPV vaccine and sexual activity. Participants were asked to indicate their level of agreement (1 = strongly disagree to 5 = strongly agree) to: “If a teenager gets the HPV vaccine, he or she may be more likely to have sex” and “My child is too young to get a vaccine for a sexually transmitted infection (STI) like HPV.”

Regarding *enabling factors*, we used a five-item CHIAS subscale to assess perceived barriers related to HPV vaccine access and cost. Participants were asked to indicate their level of agreement (1 = strongly disagree to 5 = strongly agree) to the statement “I am concerned that the HPV vaccine costs more than I can pay.” In addition, they were asked to indicate their perceived level of difficulty (1 = not hard at all to 4 = very hard) to four statements about ability to find a provider/clinic with affordable vaccine, easy access, available vaccine, and no long wait time for appointments. A higher score, derived as an average of the five item scores, indicates higher perceived barriers in accessing and being able to afford the HPV vaccine (Cronbach’s alpha = 0.83).

Regarding *reinforcing factors*, we used a CHIAS item to assess social influence on HPV vaccine uptake. Participants were asked to indicate their level of agreement (1 = strongly disagree to 5 = strongly agree) to: “Other parents in my community are getting their children the HPV vaccine.”

Sociodemographic factors

We assessed: child’s age, sex, and country of birth; and parental sex, highest education level, percentage of lifetime in the U.S., and ability to understand medical information in English. In addition, the Asian American Multidimensional Acculturation Scale (Gim Chung et al., 2004) was used to assess parental Vietnamese acculturation and parental American acculturation (Cronbach’s alphas of 0.87 and 0.92, respectively).

Statistical analysis

All data analyses were conducted in Stata 15.1. Sociodemographic, healthcare practice-, provider-, and patient-level characteristics were summarized using descriptive statistics. Bivariate analyses were conducted using chi-square and independent sample t-tests to examine sociodemographic, healthcare practice-, provider-, and patient-level characteristics in relation to (1) HPV vaccine initiation, (2) HPV vaccine completion among initiators, (3) willingness to initiate HPV vaccine among non-initiators, and (4) receiving a provider recommendation for HPV vaccine. Simple and multivariable modified Poisson regressions with robust error variance were conducted to examine correlates of each

outcome. We chose this approach instead of logistic regressions because when outcome events are common, odds ratios overestimate risk ratios (Chen et al., 2018; Greenland, 1987; Zou, 2004). In such scenarios, modified Poisson regressions with robust error variance have been shown to provide less biased estimates (Barros & Hiraakata, 2003; Chen et al., 2018; Knol et al., 2012; Zou, 2004). For each outcome, variables with significant associations ($p < 0.05$) in simple regressions were entered into the multivariable regressions. Alpha level was set at 0.05 for all analyses.

Results

We successfully recruited 408 participants from 36 U.S. states and territories. On average, we recruited 11 participants per state. States with the highest number of participants were California ($n = 117$ or 28.7% of the sample) and

Texas ($n = 61$, 15.0%). Six states had the lowest number of participants per state ($n = 1$, 0.2%).

The overall sample was 83.0% female with a mean age of 44.81. A majority of parents had at least a Bachelor’s degree (85.1%). More than half of the parents (54.4%) had adolescents ages 13 to 18. The distribution of child’s sex was roughly similar (50.7% female); so was child’s country of birth (48.5% born in the U.S.). On average, parents had spent around a third of their life in the U.S, but only 37.5% of parents reported that they could understand medical information in English well (Table 1).

Only 37.1% of parents reported seeing materials about HPV vaccine at the child’s primary clinic. A small number reported using patient navigation services (6.7%) or using language interpretation or translation services (11.1%). More than half reported receiving no provider recommendation for HPV vaccine, 13.5% reported receiving a low-quality recommendation, and approximately a third reported receiving a high-quality recommendation.

Table 1 Sociodemographic characteristics in relation to HPV vaccine initiation

Variable	Total N = 408 N (%) or M (SD)	Vaccine initiation—yes N = 166 N (%) or M (SD)	Vaccine initiation—no/ do not know N = 242 N (%) or M (SD)	<i>p</i> Value
Child’s age				
9–10	89 (21.8%)	9 (5.4%)	80 (33.1%)	<0.001
11–12	97 (23.8%)	42 (25.3%)	55 (22.7%)	
13–18	222 (54.4%)	115 (69.3%)	107 (44.2%)	
Child’s sex ^a (n = 406)				
Male	200 (49.3%)	64 (38.8%)	136 (56.4%)	<0.001
Female	206 (50.7%)	101 (61.2%)	105 (43.6%)	
Child’s country of birth				
Born in the U.S	198 (48.5%)	81 (48.8%)	117 (48.4%)	0.93
Born outside of the U.S	210 (51.5%)	85 (51.2%)	125 (51.7%)	
Parent’s sex ^a (n = 405)				
Male	69 (17.0%)	23 (13.9%)	46 (19.2%)	0.17
Female	336 (83.0%)	142 (86.1%)	194 (80.8%)	
Parent’s highest education level				
Less than a Bachelor’s degree	61 (15.0%)	26 (15.7%)	35 (14.5%)	0.02
Bachelor’s degree	157 (38.5%)	51 (30.7%)	106 (43.8%)	
Master’s degree or doctoral degree	190 (46.6%)	89 (53.6%)	101 (41.7%)	
Parent’s percentage of lifetime in the U.S	33.72 (25.38)	35.14 (26.28)	32.75 (24.76)	0.35
Parent’s ability to understand medical information in English				
Not at all to somewhat easy	255 (62.5%)	95 (57.2%)	160 (66.1%)	0.07
Very to extremely easy	153 (37.5%)	71 (42.8%)	82 (33.9%)	
Parental Vietnamese acculturation ^b (n = 407)	4.15 (0.60)	4.14 (0.63)	4.16 (0.58)	0.74
Parental American acculturation	2.88 (0.82)	3.00 (0.79)	2.80 (0.84)	0.02

^aThose who chose “Other” or “Prefer not to answer” were coded as having missing data

^bThose who indicated that their heritage culture was not Vietnamese (n = 1) were coded as having missing data

Approximately a quarter of parents agreed that their child was too young for an STI-preventing vaccine like the HPV vaccine. In addition, approximately a third agreed that other parents in their community are getting their children the HPV vaccine (Table 2).

HPV vaccine initiation

The proportion of those who initiated the HPV vaccine for their child was 40.7% of the entire sample ($n = 166/408$), 27.4% of those with adolescents ages 9–12 ($n = 51/186$), and 51.8% of those with adolescents ages 13–18

Table 2 Healthcare practice-, provider-, and patient-level characteristics in relation to HPV vaccine initiation

Variable	Total	Vaccine initiation—yes	Vaccine initiation—no/do not know	<i>p</i> Value
	N = 408	N = 166	N = 242	
	N (%) or M (SD)	N (%) or M (SD)	N (%) or M (SD)	
<i>Practice-level factors</i>				
Parent seen materials about HPV vaccine at primary clinic ^a ($n = 404$)				
No	141 (34.9%)	37 (22.4%)	104 (43.5%)	<0.001
Yes	150 (37.1%)	89 (53.9%)	61 (25.5%)	
Do not know or remember	113 (28.0%)	39 (23.6%)	74 (31.0%)	
Parent used patient navigation services ^a ($n = 404$)				
No	320 (79.2%)	128 (77.6%)	192 (80.3%)	0.80
Yes	27 (6.7%)	12 (7.3%)	15 (6.3%)	
Do not know	57 (14.1%)	25 (15.2%)	32 (13.4%)	
Parent used language interpretation or translation services ^a ($n = 404$)				
No/Do not know ^b	359 (88.9%)	152 (92.1%)	207 (86.6%)	0.08
Yes	45 (11.1%)	13 (7.9%)	32 (13.4%)	
<i>Provider-level factors</i>				
Provider's HPV vaccine recommendation quality				
No recommendation ^b	222 (54.4%)	13 (7.8%)	209 (86.4%)	<0.001
Low-quality recommendation	55 (13.5%)	39 (23.5%)	16 (6.6%)	
High-quality recommendation	131 (32.1%)	114 (68.7%)	17 (7.0%)	
<i>Patient-level factors</i>				
Vaccine confidence scale ^c				
	7.52 (1.45)	7.85 (1.35)	7.29 (1.48)	<0.001
Perceived effectiveness of HPV vaccine ^d				
	3.18 (0.85)	3.34 (0.91)	3.07 (0.80)	0.002
Child more likely to have sex after HPV vaccine initiation				
Disagree/strongly disagree	297 (72.8%)	139 (83.7%)	158 (65.3%)	<0.001
Agree/strongly agree	33 (8.1%)	6 (3.6%)	27 (11.2%)	
Do not know	78 (19.1%)	21 (12.7%)	57 (23.6%)	
Child too young for a STI-prevention vaccine like the HPV vaccine				
Disagree/strongly disagree	248 (60.8%)	143 (86.1%)	105 (43.4%)	<0.001
Agree/strongly agree	103 (25.3%)	9 (5.4%)	94 (38.8%)	
Do not know	57 (14.0%)	14 (8.4%)	43 (17.8%)	
Perceived barriers of HPV vaccine access and costs ^e				
	1.75 (0.69)	1.51 (0.56)	1.92 (0.73)	<0.001
Other parents in the community are getting children HPV vaccine				
Disagree/strongly disagree	56 (13.7%)	21 (12.7%)	35 (14.5%)	<0.001
Agree/strongly agree	143 (35.1%)	83 (50.0%)	60 (24.8%)	
Do not know	209 (51.2%)	62 (37.4%)	147 (60.7%)	

^aThose who responded that their child did not have a primary clinic ($n = 4$) were coded as having missing data

^bThe categories of “No” and “Do not know” were combined because responses of “Do not know” were less than 10% of total responses

^cRange 2.38–10, mean 7.52, standard deviation 1.45, a higher score indicates more positive attitudes towards vaccination

^dRange 1–5, mean 3.18, standard deviation 0.85, a higher score indicates higher perceived effectiveness of HPV vaccine in preventing diseases

^eRange 1–4.2, mean 1.75, standard deviation 0.69, a higher score indicates higher perceived barriers in accessing and being able to afford the HPV vaccine

(n = 115/222). The most common reasons for vaccine initiation included doctor’s recommendation (83.7%), wanting to protect child from diseases (49.4%), ensuring the child gets all recommended vaccines (33.1%), and thinking that HPV-related diseases are serious (24.7%) (Table 3).

In bivariate analyses (Model 1, Table 4), HPV vaccine initiation was associated with seeing clinic-based materials about HPV vaccine and provider recommendation (both low and high quality). In addition, HPV vaccine initiation was associated with multiple patient-level vaccine-specific factors: higher vaccine confidence, higher perceived effectiveness of HPV vaccine, lower perception that the child is more likely to have sex after HPV vaccine initiation, lower perception that the child was too young for an STI-preventing vaccine like the HPV vaccine, lower perceived barriers related to HPV vaccine access and cost, and higher perception that other parents in the community are getting the HPV vaccine. HPV vaccine initiation was also associated with child being older and female as well as higher parental education, ability to understand medical information in English, and American acculturation.

In multivariable regression (Model 2, Table 4), compared to those receiving no provider recommendation, those receiving a low-quality recommendation (adjusted relative risks or aRR = 9.08; 95% CI = 5.04–16.36) and high-quality recommendation (aRR = 10.60; 95% CI = 5.96–18.85) were more likely to have initiated the HPV vaccine for their child. Higher perception that the child was too young for an STI-preventing vaccine like the HPV vaccine was associated with lower likelihood of vaccine initiation (aRR = 0.73; 95% CI = 0.63–0.84).

HPV vaccine completion

The proportion of those who completed the HPV vaccine series was 23.3% of the entire sample (n = 95/408), 9.1% of those with adolescents ages 9–12 (n = 17/186), 35.1% of those with adolescents ages 13–18 (n = 78/222), and 57.2% of those who initiated the vaccine (n = 95/166). The most common reasons for having initiated but not completed the series (Table 3) included child starting the series too recent to finish (40.8%) and not knowing child needed more than one dose (15.5%).

In bivariate analyses (Model 1, Table 5), factors associated with HPV vaccine completion included higher vaccine confidence, lower perception that the child was too young for an STI-preventing vaccine like the HPV vaccine, and older child’s age. In multivariable regression (Model 2, Table 5), HPV vaccine completion was associated with older child’s age (aRR = 1.10, 95% CI = 1.04–1.17).

Willingness to initiate HPV vaccine

Of those who had not initiated the HPV vaccine for their child (n = 242), 45% reported that they were somewhat or very likely to initiate the vaccine in the next 12 months. The most common reasons for not having initiated HPV vaccine (Table 3) included a lack of doctor’s recommendation (62.8%), doctor’s indication that child could get vaccinated at an older age (14.1%), not thinking that child needs the vaccine because of a lack of sexual activity (13.2%), no school requirements (12.0%), and not knowing any HPV-related diseases (10.7%).

In bivariate analyses (Model 1, Table 5), factors associated with willingness to initiate HPV vaccine included receiving a high-quality recommendation, higher vaccine

Table 3 Most common reasons underlying HPV vaccine initiation, non-initiation, or initiation but non-completion

Reasons	N (%)
Most common reasons for initiating HPV vaccine (total n = 166)	
A doctor recommended it for my child	139 (83.7%)
I want to protect my child from diseases	82 (49.4%)
I get my child all recommended vaccines	55 (33.1%)
I think HPV-related diseases are serious	41 (24.7%)
Most common reasons for having initiated but not completed HPV vaccine series (total n = 71)	
My child started the series too recently to finish	29 (40.8%)
I didn’t know my child needed more than 1 dose	11 (15.5%)
Most common reasons for not having initiated HPV vaccine (total n = 242)	
Doctor never recommended HPV vaccine for my child	152 (62.8%)
Doctor indicated that my child can get vaccinated at an older age	34 (14.1%)
My child is not sexually active, so I do not think the vaccine is necessary	32 (13.2%)
My child’s school does not require vaccination, so I do not think the vaccine is necessary	29 (12.0%)
I do not know about any HPV-related disease	26 (10.7%)

Table 4 Healthcare practice-, provider-, and patient-level predictors of HPV vaccine initiation

Variable	Model 1 (unadjusted) cRR (95% CI)	Model 2 (adjusted) aRR (95% CI)
<i>Practice-level factors</i>		
Parent seen materials about HPV vaccine at primary clinic		
No/Do not know	Reference	Reference
Yes	1.98 (1.57–2.50)***	1.16 (0.98–1.37)
<i>Provider-level factors</i>		
Provider's HPV vaccine recommendation quality		
No recommendation	Reference	Reference
Low-quality recommendation	12.11 (6.95–21.09)***	9.08 (5.04–16.36)***
High-quality recommendation	14.86 (8.73–25.30)***	10.60 (5.96–18.85)***
<i>Patient-level factors</i>		
Vaccine confidence scale	1.18 (1.09–1.28)***	0.98 (0.91–1.06)
Perceived effectiveness of HPV vaccine	1.24 (1.08–1.43)**	0.98 (0.89–1.08)
Child is more likely to have sex after HPV vaccine initiation	0.77 (0.66–0.89)***	1.04 (0.94–1.15)
Child is too young for a STI-prevention vaccine like HPV vaccine	0.58 (0.51–0.65)***	0.73 (0.63–0.84)***
Perceived barriers related to HPV vaccine access and cost	0.52 (0.41–0.67)***	0.86 (0.72–1.01)
Other parents in the community are getting HPV vaccine	1.37 (1.18–1.58)***	1.05 (0.96–1.15)
<i>Sociodemographic characteristics</i>		
Child's age	1.14 (1.10–1.19)***	1.01 (0.98–1.04)
Child's sex		
Male	Reference	Reference
Female	1.53 (1.20–1.96)**	1.07 (0.92–1.25)
Parent's highest education level		
Bachelor's degree or less	Reference	Reference
Master's degree or doctoral degree	1.33 (1.05–1.68)*	1.12 (0.96–1.31)
Parent's ability to understand medical information in English	1.13 (1.00–1.27)*	0.97 (0.88–1.07)
Parental American acculturation	1.20 (1.03–1.39)*	0.93 (0.81–1.08)

Simple and multivariable modified Poisson regressions with robust error variance were conducted to examine correlates of the outcome

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

confidence, higher perceived effectiveness of HPV vaccine, lower perception that the child is more likely to have sex after HPV vaccine initiation, and lower perception that the child was too young for an STI-preventing vaccine like the HPV vaccine. In multivariable regression (Model 2, Table 5), compared to those receiving no provider recommendation, those receiving high-quality recommendation were more likely to be willing to initiate the HPV vaccine for their child (aRR = 1.57, 95% CI = 1.15–2.14). Higher perception that the child was too young for an STI-preventing vaccine like the HPV vaccine was associated with lower likelihoods of willingness to initiate the vaccine (aRR = 0.86; 95% CI = 0.77–0.98).

Provider recommendation for HPV vaccine

In the sample, 45.6% indicated that they had ever received provider recommendation and 32.1% indicated receiving a high-quality recommendation. Among all parents who received provider recommendation ($n = 186$), only 22.0% indicated that the provider recommended for the child to start the HPV vaccine at an age of 12 or younger (not shown in tables). In bivariate analyses (not shown in tables), sociodemographic correlates of receiving provider recommendation were child being older and female, higher parental percentage of lifetime in the U.S., ability to understand medical information in English, and American acculturation.

Table 5 Healthcare practice-, provider, and patient-level predictors of HPV vaccine completion & willingness to initiate HPV vaccine

Variable	Model 1 (unadjusted) cRR (95% CI)	Model 2 (adjusted) aRR (95% CI)
<i>Outcome: vaccine completion (among those who had initiated the vaccine for their children, n = 166)</i>		
Vaccine confidence scale	1.12 (1.01–1.24)*	1.05 (0.94–1.17)
Child is too young for a STI-prevention vaccine like HPV vaccine	0.79 (0.65–0.98)*	0.84 (0.68–1.05)
Child's age	1.11 (1.05–1.18)***	1.10 (1.04–1.17)**
<i>Outcome: willingness to initiate HPV vaccine (among those with unvaccinated children, n = 242)</i>		
Provider's HPV vaccine recommendation quality		
No recommendation	Reference	Reference
Low-quality recommendation	1.22 (0.72–2.04)	1.22 (0.72–2.08)
High-quality recommendation	1.57 (1.07–2.32)*	1.57 (1.15–2.14)**
Vaccine confidence scale	1.14 (1.03–1.25)**	1.05 (0.95–1.17)
Perceived effectiveness of HPV vaccine	1.29 (1.08–1.54)**	1.16 (0.98–1.38)
Child is more likely to have sex after vaccine initiation	0.82 (0.70–0.96)*	0.91 (0.77–1.08)
Child is too young for a STI-prevention vaccine like HPV vaccine	0.82 (0.73–0.92)**	0.86 (0.77–0.98)*

Simple and multivariable modified Poisson regressions with robust error variance were conducted to examine correlates of each outcome

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

In multivariable regression (not shown in tables), receiving provider recommendation was associated with the child being older (aRR = 1.15, 95% CI = 1.11–1.20) and female (aRR = 1.35, 95% CI = 1.10–1.65), and higher parental American acculturation (aRR = 1.27, 95% CI = 1.09–1.48). Of those who had received provider recommendation, we did not find any significant associations between sociodemographic characteristics and receiving low-quality versus high-quality recommendations (not shown in tables).

Discussion

Our study represents the first effort to examine healthcare practice-, provider-, and patient-level determinants of U.S. Vietnamese parents' HPV vaccine decision-making for their adolescent children. We found that only 41% had initiated and 23% had completed the vaccine series for their child; further, 46% received provider recommendation for HPV vaccine. Vaccine initiation was associated with receiving provider recommendation for vaccination (either low- or high-quality), while willingness to initiate the vaccine was associated with receiving a high-quality recommendation (which occurred among 32% of participants). In addition, both vaccine initiation and willingness to initiate the vaccine was negatively associated with parental perception that their child was too young for an STI-preventing vaccine.

Among adolescent ages 13 to 18 in our sample, the prevalence of HPV vaccine initiation and completion was 52 and 35%, respectively. In contrast, the 2020 NIS-Teen, which

surveyed vaccination coverage of U.S. adolescents ages 13–17, estimated that 75 and 59% of all adolescents and 77 and 61% non-Hispanic Asian adolescents had initiated and completed the HPV vaccine series, respectively (Pingali et al., 2021). Moreover, the on-time initiation rate among those ages 9–12 in our sample was 27%, in contrast to the nationwide rate of 63% in 2018 (Chido-Amajuoyi et al., 2021). These stark disparities necessitate strategies and interventions to address low adolescent HPV vaccination coverage among U.S. Vietnamese. Furthermore, interventions should aim to address barriers to not only HPV vaccine initiation but also vaccine completion, particularly given that 16% of parents who had initiated the vaccine did not know that their child needed more than one dose.

The strong positive association between provider recommendation and parents' HPV initiation for their child, as documented in our study, has also been reported in general populations (Newman et al., 2018), immigrant populations (Kim & LeClaire, 2017), Asian populations (Dela Cruz et al., 2018; Vu et al., 2020a), and U.S. Vietnamese parents of daughters ages 9–26 (Yi et al., 2013b). However, unlike most previous studies that only measured the presence or absence of provider recommendation, we assessed several aspects of recommendation (e.g., quality, recommended age, subgroups more likely to receive recommendation). While Vietnamese parents receiving high-quality recommendations were more likely to be willing to initiate the vaccine for their child in the next 12 months, no association was found among those receiving low-quality recommendations. A similar result was reported in a study with U.S. parents,

where parents who had initially refused HPV vaccination but received a high-quality recommendation were more likely to get their child vaccinated during a later visit (i.e. secondary acceptance) (Kornides et al., 2018). This study also found that low-quality recommendations did not have an impact on secondary acceptance (Kornides et al., 2018).

Less than a quarter of all Vietnamese parents who received provider recommendation reported that their providers recommended an age of 12 or younger for their child to start the HPV vaccine. This finding may reflect documented practices where providers based their recommendations on perceptions of adolescents' sexual risks or access to care rather than the ages in ACIP's guidelines (Henrikson et al., 2016). Additionally, Vietnamese parents of sons were less likely to have received a provider recommendation compared to parents of daughters, a pattern also noted in previous research with general U.S. populations (Beavis et al., 2018). Moreover, through using validated measurements for acculturation, we found that Vietnamese parents with higher U.S. acculturation were more likely to receive a provider recommendation, independent of their ability to understand medical information in English or duration in the U.S. It is possible that those with higher U.S. acculturation may place a higher emphasis on preventive care (Geltman et al., 2014) and thus more likely to take their child to a doctor's visit, thereby creating more opportunities to receive a provider recommendation. This association should be further explored in Vietnamese populations and other immigrant populations.

Taken together, these findings indicate the need for actions to ensure high-quality and age-based provider recommendation for HPV vaccine for U.S. Vietnamese parents of both male and female adolescents. Dimensions of high-quality recommendations can include emphasizing the importance and cancer prevention values of the vaccine, recommending same-day vaccination, delivering recommendations to all adolescents by age 12, and recommending the HPV vaccine at the same time and in the same way as other adolescent vaccines (Gilkey & McRee, 2016). The literature has documented several effective provider-focused interventions for general U.S. populations that utilized educational presentations, audit and feedback, and training in communication approach with parents (Leung et al., 2019), though we are not aware of research implementing such interventions in healthcare systems serving U.S. Vietnamese or Asian communities. For example, a multi-component intervention in Colorado implemented webinar and in-person communication training for providers regarding the use of the "presumptive announcement" approach to open the HPV vaccine conversation and motivational interviewing strategies for vaccine hesitant parents (Dempsey et al., 2018; Reno et al., 2018, 2019). Providers reported that the communication training was one of the most important components of

the intervention, and adolescents in the intervention practices were significantly more likely to initiate and complete the HPV vaccine series compared to those in the control practices (Dempsey et al., 2018). Another multi-component intervention in Ohio provides both communication training to all providers and individualized audits to providers who missed an opportunity to vaccinate a patient against HPV (Krantz et al., 2018). The intervention resulted in more consistently-occurring vaccination during visits and increased vaccine initiation and completion rates (Krantz et al., 2018).

A quarter of parents in the sample believed that their child was too young for an STI-preventing vaccine. This perception was negatively associated with HPV vaccine initiation and willingness to initiate the vaccine. In addition, of parents who had not initiated the HPV vaccine, 13% cited their child's lack of sexual activity as a reason for non-initiation. A few studies have reported similar concerns in Korean, Cambodian, and Haitian immigrant populations (Do et al., 2009; Lee et al., 2019b; Stephens & Thomas, 2013). The 2016 NIS-Teen data indicated that between 9 and 10% of U.S. parents reported their child's lack of sexual activity as a primary reason for why they would not get their child vaccinated in the next 12 months (Beavis et al., 2018). Educational programs and interventions should address this perception by emphasizing that HPV vaccine is the most effective when administered prior to sexual debut (Adams et al., 2007). Moreover, sexual activity is not the only possible source of exposure to HPV, as there are non-sexual and non-penetrative sources of HPV transmission (Liu et al., 2016).

It should be noted that our study took place from April to December 2020 during the COVID-19 pandemic. HPV vaccine ordering and coverage dropped substantially in 2020 (Daniels et al., 2021; Gilkey et al., 2020), possibly due to a number of challenges such as decreased capacity of primary clinics, limited interactions between providers and patients, and parents' delay of preventive care visits based on fears of COVID-19 exposure (Gilkey et al., 2020). These barriers could have led to reduced opportunities for HPV vaccination for adolescents in our study, particularly those who became eligible for vaccination during the period of this research. Recent efforts to improve HPV vaccine uptake have emphasized strategies such as co-administration of HPV vaccine with COVID-19 vaccines for adolescents (Committee on Infectious Diseases at the American Academy of Pediatrics, 2021).

Strengths and limitations

Strengths of our study include the recruitment of U.S. Vietnamese parents from diverse sources (e.g., community-based organizations, Facebook groups) and the use of a rigorous translation process. We assessed determinants of HPV vaccine decision-making using comprehensive, validated

measurements (e.g., multiple dimensions of provider recommendation or of acculturation). Nevertheless, our survey is cross-sectional, which limits interpretations of temporal relationships between variables. We also relied on parents' self-reports of HPV vaccination status, which is subjected to inaccuracy (Vu et al., 2019b). Additionally, we assessed the vaccination status of the oldest child, which can be subjected to recall bias. While we did not find any association between practice-level factors and HPV vaccine outcomes, this result could be due to the fact that we captured practice-level factors from parents' perspectives. Future studies could consider exploring the perspectives of clinic staff or using ethnographic research to further understand practice-level influences on HPV vaccine decision-making. Other confounding variables, such as the length or quality of the relationship between patients and providers, can also be considered. Given our focus on parents' perspectives, we were not able to measure additional provider-level correlates that may be important, such as provider's attitudes, beliefs, or practices regarding HPV vaccination. Additionally, we measured parents' perceptions of provider recommendation quality, which may not always match with provider's perceptions.

The generalizability of our findings may have been limited given that the majority of parents were college-educated. It is possible that those who have higher education were more likely to participate in health research (Ashford et al., 2020; Würtzen et al., 2013). We note, however, that recent systematic reviews in general and Asian American populations have not identified a definite relationship between education and HPV vaccine uptake (Newman et al., 2018; Radisic et al., 2017; Rodriguez et al., 2020; Vu et al., 2020a). Moreover, almost all parents (99.3%) in our study reported that their child had health insurance. Since having health insurance has been shown to be associated with higher HPV vaccine uptake (Kessels et al., 2012; Newman et al., 2018), the observed level of vaccine uptake in our study may have been lower if more Vietnamese parents with uninsured children had been included.

Conclusions

U.S. Vietnamese parents reported low HPV vaccine initiation and completion for their adolescents. Future provider-facing interventions should promote high-quality, age-based, gender-neutral HPV vaccine recommendation. These and population- and individual-facing interventions should recognize the need for additional parental education, particularly related to misconceptions regarding STI prevention.

Authors' contribution MV is responsible for conceptualizing the study, designing the survey, overseeing data collection, performing

data analysis, and drafting and editing the manuscript. RAB, CE, and CJB all contributed to survey designing, data analysis, and manuscript editing. DT and VHN contributed to data collection, data analysis, and manuscript editing. All authors have reviewed the submitted manuscript and approve the manuscript for submission.

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Declarations

Conflict of interest The authors declare that they have no conflicts of interest.

Ethics approval for research involving human participants We received approval for research involving human participants from the Institutional Review Board at Emory University (IRB 00111688). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent/consent to participate Electronic/online informed consent was provided by all participants.

Animal studies No animal studies were carried out by the authors.

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