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U.S. Vietnamese parents' trusted sources of information and preferences for intervention messaging about HPV vaccination: A mixed methods study

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ABSTRACT

Objective: Assess trusted sources of information, perceived message effectiveness, and preferred dissemination strategies regarding adolescent HPV vaccination among U.S. Vietnamese parents.
Methods: Data came from an observational, explanatory sequential mixed-methods study with U.S. Vietnamese parents of adolescents (408 survey participants; 32 interview participants). Surveys and interviews were conducted in both Vietnamese and English. Mixed-methods data were integrated and analyzed for confirmation, expansion, or discordance.
Results: Both quantitative and qualitative findings confirm high trust in HPV vaccination information from providers, government agencies, and cancer organizations. Messages perceived as effective emphasize vaccine safety, experts' endorsement, importance of vaccination prior to HPV exposure, and preventable cancers. Qualitative findings expanded quantitative results, demonstrating a desire for evidence-based information in the Vietnamese language and addressing cultural concerns (e.g., effectiveness or potential side effects specific to Vietnamese adolescents, whether parents should delay HPV vaccination for Vietnamese adolescents). Quantitative and qualitative findings were incongruent about whether parents would trust information about HPV vaccination that is disseminated via social media.
Conclusion: We identified credible messengers, feasible strategies, and elements of impactful messages for interventions to increase adolescent HPV vaccination for U.S. Vietnamese.
Innovation: We focus on a high-risk, underserved population and integrate mixed-methods design and analysis.

1. Introduction

Human papillomavirus (HPV) vaccination is safe and effective; it provides sustained and close to 100% protection against genital warts and several HPV-related cancers such as cancers of the cervix, vulva, vagina, penis, anus, or oropharynx [1,2]. Despites its benefits, in the U.S., the rate of HPV vaccine initiation (77% in 2021) lags behind that of other recommended adolescent vaccines such as the tetanus, diphtheria, and acellular pertussis vaccine (Tdap; 90% in 2021) or the meningococcal conjugate vaccine (89% in 2021) [3]. The National Institutes of Health recently called for research to improve the acceptance and uptake of HPV vaccination, especially in populations at increased risk for morbidity and mortality from HPV-related cancers due to long-standing systemic inequities [4].

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One population experiencing such disparities is U.S. Vietnamese, defined as those living in the U.S. and self-identifying as Vietnamese. Numbering around 2.3 million, they are the fourth largest Asian origin group in the U.S. [5]. They bear a high burden of socioeconomic disadvantages and barriers to health services utilization [5]. U.S. Vietnamese experienced a higher cervical cancer incidence rate (9.0 per 100,000) compared to non-Hispanic White (7.5) and all Asian (6.5) populations combined [6]. Furthermore, in 2020, U.S. Vietnamese adolescents had lower HPV vaccine uptake (52% initiation and 35% completion of the vaccine series) compared to national estimates for all adolescents (75% initiation and 59% completion) [7,8].

These stark disparities necessitate solutions specifically targeting U.S. Vietnamese and addressing low HPV vaccination coverage, ultimately decreasing HPV-related cancer burdens in this population. Effective health education interventions can improve U.S. Vietnamese community members' knowledge and demand for HPV vaccination, subsequently encouraging clinic visits, discussions with providers, and vaccine uptake [9]. Engaging the community to understand their specific preferences, barriers to, and desire for health education about HPV vaccination is a critical formative step to design impactful interventions [10,11]. Such research can elucidate how social influences, social role and identity, knowledge, and beliefs affect HPV vaccine decision-making among U.S. Vietnamese [12].

In particular, trust and mistrust play a significant role in HPV vaccine decision-making in racial and ethnic minoritized populations in the U.S., and trusted sources of information about HPV vaccination can differ greatly among communities [13]. Therefore, it is critical to assess trusted sources of information for U.S. Vietnamese to inform the delivery of educational interventions. Moreover, the influences of specific cultural contexts or histories on HPV vaccination in racial and ethnic minoritized communities have been documented. For instance, a project with diverse parents of adolescents in Hawai'i found that they preferred health education materials made specifically for Hawai'i (as opposed to mainland) that featured local faces and testimonials [14]. In contrast, in another study, African American parents discussed their hesitancy towards HPV vaccination and their mistrust of the government and pharmaceutical companies given medical abuse and atrocities committed against African Americans [10]. Participants in this study voiced the desire for visual materials that include people from diverse groups to avoid any feeling of being targeted [10]. These examples demonstrate the need to consider specific preferences and concerns of different communities.

Additionally, previous research has demonstrated variations in preferred information dissemination strategies, which further emphasizes the importance of evaluating these factors in intervention design and development. For example, while several studies with parents or caregivers showed their preferences for receiving health information about HPV vaccination through in-person community-based events (e.g., health fairs, church gathering) or through the doctor's office [9,14], research with adolescents or young adults indicated that they were generally interested in receiving information via social media channels instead [15,16].

In addition, it is important to identify what messages are deemed effective or what content is desired by U.S. Vietnamese parents in order to increase the impacts of health education interventions on HPV vaccination. For example, several research studies have tested different framing of messages around HPV vaccination (e.g., focusing on cancer prevention, debunking the link between HPV vaccination and sexual activity, emphasizing the benefits associated with vaccination or the consequences associated with non-vaccination) in different populations [17-20]. To our knowledge, however, no study has investigated desired educational content or perceived effectiveness of health messages around HPV vaccination for U.S. Vietnamese.

In our current study, we focus on parents, as the HPV vaccine is the most effective when given before the age of 15 [21,22] and parents are the primary decision-makers of adolescent HPV vaccination [23]. To date, we are not aware of research that has comprehensively queried intervention content, delivery channels, and strategies to disseminate evidence-based information about HPV vaccination to U.S. Vietnamese parents. This study fills existing gaps in the literature. Using a mixed-methods design, we assess trusted sources of information, effective messages, desired educational content, and preferred dissemination strategies regarding adolescent HPV vaccination among these parents. We also query whether trusted sources of information and perceived effectiveness of messages differ between parents who had initiated the vaccine for their adolescents and those who had not. Findings can inform approaches to improve HPV vaccine uptake in U.S. Vietnamese, a high-risk, underserved population.

2. Methods

2.1. Setting, study design, and participants

Study data came from an explanatory, sequential mixed-methods project to investigate multilevel factors influencing HPV vaccine decision-making among U.S. Vietnamese parents. Details about eligibility criteria and study recruitment have been previously published [24]. Briefly, between April and December 2020, we recruited 408 U.S. Vietnamese parents (both males and females) of adolescents aged 9 to 18 via community-based organizations (CBOs), social media, personal networks, and snowball sampling to participate in a web-based survey [7]. For this phase, 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 aged 9 to 18 living in the same household. Only one parent per household was allowed to participate. We did not specify the parental relationship (e.g., biological, step, or adoptive parent). We used the American Association for Public Opinion Research's (AAPOR) response rate calculator version 4.1 to determine response rates [25]. The overall response rate from the web-based survey was 72% (range: 51.5% for Vietnamese CBOs to 86.6% for social media).

Then, between November 2020 and February 2021, we invited a subset of 38 mothers from the survey sample, who had adolescents aged 12 to 18, to participate in in-depth, semi-structured qualitative interviews [26], of which 32 agreed and participated (84% response rate). In this phase, we focused on mothers, as our survey sample was comprised mostly of female caregivers (83%) [7] and previous studies with different populations have found that mothers are typically the primary decision-makers about HPV vaccination for both male and female adolescents [27-29]. The Institutional Review Board at Emory University approved this study (IRB00111688).

2.2. Measure development and data collection

The web-based survey was translated using an iterative process which involved an independent translation of survey items into Vietnamese and back-translation into English by two different translators [30]. Then, the first author (who is fully fluent in both languages) and approximately 10 Vietnamese native speakers reviewed the translated survey items to further ensure linguistic equivalence. Interviews were conducted in either English or Vietnamese based on participants' preferences. The interview guide (Appendix A) was pilot-tested through internal testing with research team members and field-testing with three survey participants.

2.3. Survey measures

2.3.1. Main variables of interest: information sources, trust in sources and perceived message effectiveness

Survey questions were adapted from the Health Information National Trends Survey (HINTS) 5 Cycle 2 [31] to assess information sources and trust in information sources about HPV and the HPV vaccine. We asked: “Where have you gotten information about HPV or the HPV vaccine? Please select all categories that apply” and “In general, how much would you trust information about HPV or the HPV vaccine from each of the following sources?” These two questions were asked for: cancer organizations; government health agencies; religious organizations and leaders; family members or relatives; friends or coworkers; doctors or other healthcare providers; radio; television; newspapers or magazines; and social media

(e.g., Facebook, Twitter, Instagram, YouTube). Response options were: Not at all, A little, Somewhat, A lot; and I am not sure. We dichotomized this variable as 0 = Not at all, A little, or I am not sure; and 1 = A lot.

Adapting items used in past research with national samples of U.S. parents and physicians [32], we assessed participants' perceptions of 10 motivational messages about HPV vaccination. We asked: "Please indicate how effective you think each of these statements made by a doctor or other healthcare professional is in persuading a parent to get the HPV vaccine for their child." Response options were: Slightly effective; Moderately effective; Very effective; Extremely effective; and I do not know. We dichotomized this variable as 0 = Slightly effective, Moderately effective, or I do not know; and 1 = Very effective or Extremely effective.

2.3.2. Stratification variable: adolescent HPV vaccine initiation status

HPV vaccine initiation was assessed by asking, "Has your child ever received HPV vaccine shots?" [33]. 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 the question considering their oldest child in the age range.

We included HPV vaccine initiation as a stratification variable because we were interested in possible differences in trusted sources of information and perceived message effectiveness based on HPV vaccine initiation status. This information is particularly useful for determining whether there are particular messages or sources of information that resonate with those with unvaccinated adolescents.

2.3.3. Descriptive variables: sociodemographic characteristics

We captured data on parent's age, sex, highest education level, percentage of lifetime in the U.S., and ability to understand medical information in English. Parents' Vietnamese acculturation and American acculturation scores were separately assessed using the Asian American Multidimensional Acculturation Scale [34], with higher scores indicating higher levels of acculturation. We also assessed the child's age, sex, and place of birth.

2.4. Interview guide

Survey findings were used to inform the interview guide. Interview questions expanded upon survey items and explored preferred and trustworthy sources of information about the HPV vaccine. In addition, we elicited feedback about topics that should be included in health education around HPV vaccination and approaches to incorporate Vietnamese culture into health education around HPV vaccination. Examples of questions included but were not limited to: "Would you like to have more ways to learn about HPV and HPV vaccine? From whom or where would you like to learn such information? What kind of messages about HPV vaccine would encourage vaccination? What Vietnamese cultural beliefs around vaccination or HPV vaccination should the messages address?"

2.5. Data analysis

All statistical analyses were conducted in Stata 16.0. Descriptive statistics were used to summarize 1) information sources and trust in information sources about HPV and the HPV vaccine 2) perceived effectiveness of messages about HPV vaccination. Bivariate analyses were conducted using chi-square tests to examine use of and trust in information sources and perceived effectiveness of motivational messages in relation to adolescents' HPV vaccine initiation status (statistical threshold set at 0.05).

All interviews were recorded and transcribed verbatim. The Vietnamese transcripts (24 out of 32) were then translated into English by two professional translators. Bilingual members of the research team reviewed and validated the translations to ensure accuracy. All interview data were analyzed using MAXQDA 2020. We used a hybrid approach of qualitative thematic analysis, which incorporated both 1) a deductive a priori template of codes and themes from the survey items and 2) a data-driven inductive approach [35]. First, MV and DT independently reviewed five transcripts [36], generated qualitative codes using open, axial, and selective coding [37-39], and created a codebook with code definitions, examples, inclusion, and exclusion criteria [37]. Then, using the codebook, the two coders independently recoded the initial transcripts. Each coder independently coded remaining transcripts, constantly comparing results and resolving any discrepancies (i.e., all transcripts were double-coded). Additional information about the qualitative data analysis process, including steps taken to reach saturation and establish validity and trustworthiness of findings, has been previously published [29]. We operationalized the frequency of themes that appeared in interviews as "all" (100% of interviews), "most" (75–99%), "the majority" (50–74%), "several" (20–49%), and "a few" (<20%).

Mixed methods integration occurred through the explanatory sequential design of the study [40] that connected the survey and interview samples. MV and DT further merged mixed methods data and presented quantitative and qualitative findings in a joint display with meta-inferences [41,42]. MV and DT analyzed the quantitative and qualitative data for confirmation (i.e. findings from both types of data reinforced the results of each other), expansion (i.e. findings from each dataset expanded insights or addressed complementary aspects), or discordance (i.e. findings from each dataset contradicted each other) [42].

3. Results

3.1. Sociodemographic characteristics

Table 1 displays the sociodemographic of all 408 survey participants and of the 32 interview participants. The majority of parents reported low ability to understand medical information in English (62.5% for both survey and interview participants). In both samples, on average, parents had higher Vietnamese acculturation scores compared to American acculturation scores. On average, parents had spent approximately a third of their lifetime in the U.S.

Among survey participants, 59.3% had not initiated HPV vaccine for their adolescent, 17.4% had initiated but not completed the series, and 23.3% had completed the series. Among interview participants, 37.5% had not initiated HPV vaccine for their adolescent, 21.9% had initiated but not completed the series, and 40.6% had completed the series. During the sampling phase for interview participants, we strived to obtain roughly equal subgroup proportions for adolescents' sex and HPV vaccination status. We did not aim for the proportions of vaccination status (not yet initiated, initiated but not completed, and completed) in the interview sample to match what was observed in the survey sample; rather, in the interview sample, we purposively aimed for each category to represent roughly a third of the sample.

3.2. Quantitative survey results

3.2.1. Information sources and trust in sources

As shown in Fig. 1, the most common information source about HPV or the HPV vaccine was doctors or other healthcare providers (40.7%), followed by friends and coworkers (22.1%). The least common sources were religious organizations and leaders (0.2%), cancer organizations (3.9%), radio (4.4%), and government health agencies (7.4%). Compared to participants with adolescents who had initiated the vaccine series, smaller proportions of those with unvaccinated adolescents indicated having received information about HPV or the HPV vaccine from doctors or healthcare providers, government health agencies, and radio (Table 2).

Many participants indicated a lot of trust in information from doctors or other healthcare providers (77.2%), government health agencies (61.3%), and cancer organizations (58.6%) (Fig. 1). In contrast, few indicated that they had a lot of trust in information from social media (3.2%), religious organizations and leaders (6.1%), or radio (9.6%) (Fig. 1). Compared to participants with adolescents who had initiated the vaccine series, smaller proportions of those with unvaccinated adolescents indicated a lot of trust in doctors or healthcare providers, social media, government health agencies, and cancer organizations (Table 2).

Table 1
Sociodemographic, acculturation, and HPV vaccination characteristics of survey participants and interview participants.

Variable	All survey participants	Interview participants (subset of the survey participants)
	$N = 408$	$N = 32$
	N (%) or M (SD)	*N* (%) or M (SD)
Child's HPV vaccination status		
Not initiated	242 (59.3%)	12 (37.5%)
Initiated but not completed	71 (17.4%)	7 (21.9%)
Completed	95 (23.3%)	13 (40.6%)
Child's sociodemographic characteristics		
Child's age		
9 to 12	186 (45.6%)	1 (3.1%)
13 to 18	222 (54.4%)	31 (96.9%)
Child's sex[a]		
Male	200 (49.3%)	18 (56.3%)
Female	206 (50.7%)	14 (43.8%)
Child's country of birth		
Born in the U.S.	198 (48.5%)	19 (59.4%)
Born outside of the U.S.	210 (51.5%)	13 (40.6%)
Parent's sociodemographic characteristics		
Parent's age	43.50 (5.77)	45.06 (2.23)
Parent's sex[a]		
Male	69 (17.0%)	0 (0.0%)
Female	336 (83.0%)	32 (100.0%)
Parent's highest education level		
Bachelor's degree or less	218 (53.5%)	13 (40.7%)
Master's degree or doctoral degree	190 (46.5%)	19 (59.3%)
Parent's percentage of lifetime in the U.S.	33.72 (25.38)	29.54 (26.47)
Parent's ability to understand medical information in English		
Not at all to somewhat easy	255 (62.5%)	20 (62.5%)
Very to extremely easy	153 (37.5%)	12 (37.5%)
Parental Vietnamese acculturation (range 0–5)[b]	4.15 (0.60)	4.05 (0.56)
Parental American acculturation (range 0–5)[b]	2.88 (0.82)	3.11 (0.71)

[a] Those who chose "Other" or "Prefer not to answer" were coded as having missing data.
[b] Those who indicated that their heritage culture was not Vietnamese ($n = 1$ for survey participants, $n = 0$ for interview participants) were coded as having missing data.

3.2.2. Perceived message effectiveness

Provider-delivered messages most commonly rated as very to extremely effective for persuading a parent to get the vaccine for their adolescent emphasized the safety of the HPV vaccine (74.7%), experts' endorsement of the HPV vaccine (68.1%), the importance of HPV vaccination prior to HPV exposure via sexual activity (67.7%), and the cancer prevention benefits of HPV vaccination (67.2%) (Table 3). In contrast, fewer than half of the participants rated messages emphasizing providers decision to vaccinate their own child (38.0%) or the non-association between HPV vaccine and early sexual debut (48.3%) as very to extremely effective (Table 3).

For 7 out of 10 messages, compared to those who had initiated the vaccine series for their adolescents, smaller proportions of participants with unvaccinated adolescents rated these messages as very to extremely effective (Table 4). However, the orders of ranking appear similar between both groups. For example, both groups most commonly rated the message emphasizing the safety of the HPV vaccine as very to extremely effective. Messages emphasizing providers' decision to vaccinate their own child or no association between HPV vaccine and early sexual activity were least commonly rated as very to extremely effective by both groups (See Table 4).

3.3. Qualitative interview themes

3.3.1. Parents expressed support for a web-based educational platform and indicated desire for information about vaccine safety and effectiveness, possible side effects, benefits, eligibility, and access

Most participants expressed support for a web-based educational platform to provide additional information about the HPV vaccine. They highlighted the personal importance of this information source and its potential impact on the wider Vietnamese community. For example, a participant said: "I'm working with [U.S. Vietnamese] families, I oversee family programming. We are trying to support families or parents with different things. If there's such a website [about the HPV vaccine] in both English and Vietnamese, for a program like us we can connect with that website right and provide that resource to the parents. I think that's great" (#31, male adolescent, completed series).

The majority of participants wanted to know about the safety and possible side effects of the HPV vaccine. A participant said: "I would be afraid [of the HPV vaccine] if I didn't have enough information… about the possible side effects. When people are provided with complete information [about the vaccine], they will be less afraid, not more afraid. They will be afraid when they do not have enough information" (#11, female adolescent, completed series). Another stated: "Most of the concerns of a Vietnamese parent is the side effects. They look or pay attention more to the side effects than what the vaccine can do to help prevent." (#32, male adolescent, not initiated series). Another mother added: "If a child gets this vaccine, in the future, will there be any impact on her physical development into womanhood?" (#07, female adolescent, completed series).

Additionally, most participants desired information about the effectiveness of the vaccine, cancers and diseases prevented by the vaccine, age eligibility for vaccination, required number of doses, costs, and access to the vaccine. For example, one participant asked: "Is the cost of vaccination covered by insurance or parents? Where can we get the vaccine?... People need to know this information" (#21, male adolescent, not initiated series).

3.3.2. Health education should incorporate Vietnamese language and address cultural concerns about HPV vaccination

Several discussed the need for health education information to be in the Vietnamese language. A participant stated: "People prefer learning about

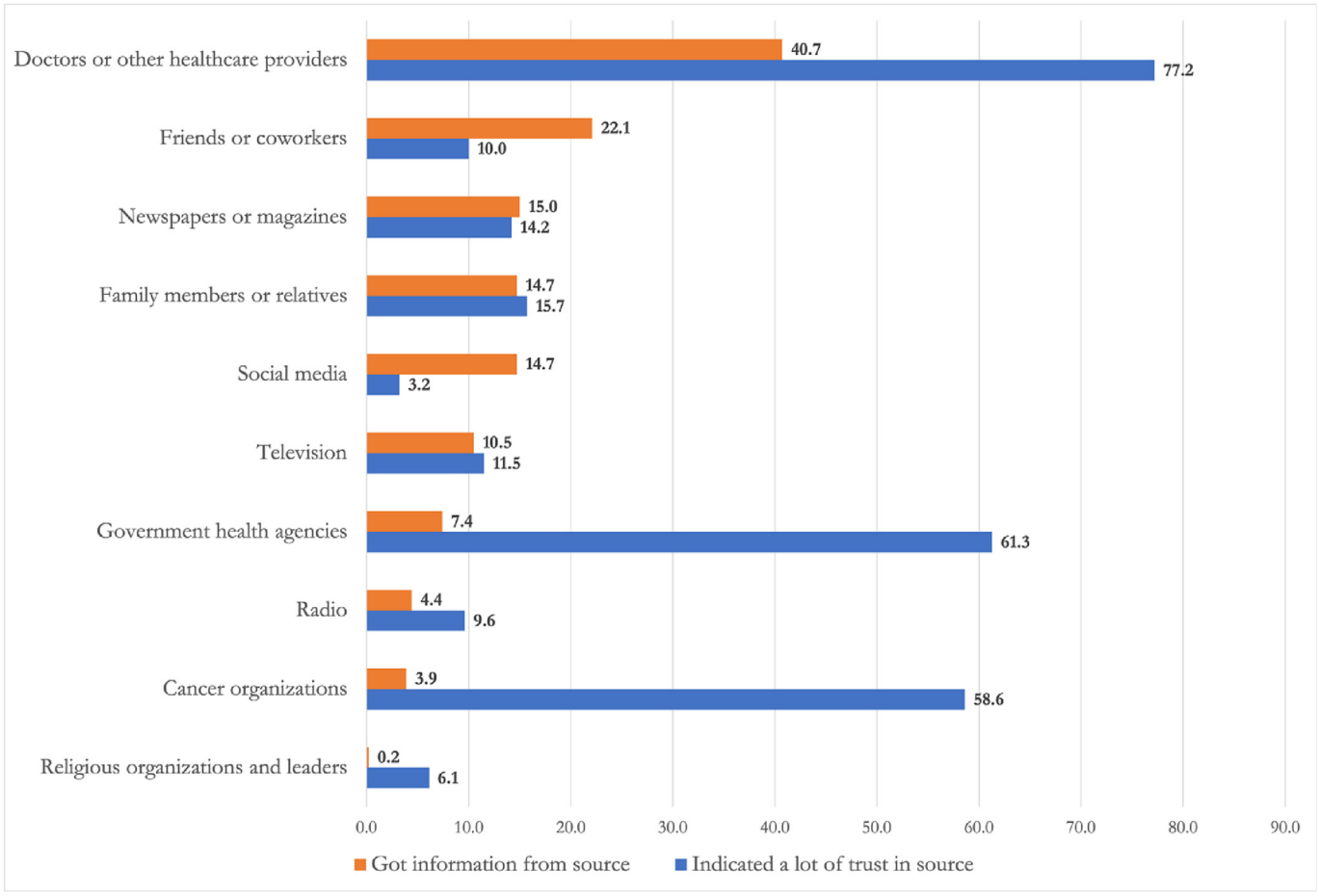

Fig. 1. Use of and trust in sources of information about HPV vaccination.

Table 2
Utilization and trust in information sources about HPV vaccination in relation to adolescent HPV vaccine initiation status.

Information source	Have gotten information about HPV vaccination from source		Indicate a lot of trust in source	
	Vaccine initiation - No	Vaccine initiation - Yes	Vaccine initiation - No	Vaccine initiation - Yes
	N = 242	*N* = 166	*N* = 242	*N* = 166
	N (%)	*N* (%)	*N* (%)	*N* (%)
Doctors or healthcare providers	53 (21.9%) (*)	113 (68.1%) (*)	173 (71.5%) (*)	142 (85.5%) (*)
Friends or coworkers	51 (21.1%)	39 (23.5%)	20 (8.3%)	21 (12.7%)
Newspapers or magazines	34 (14.1%)	27 (16.3%)	29 (12.0%)	29 (17.5%)
Family members or relatives	35 (14.5%)	25 (15.1%)	31 (12.8%)	33 (19.9%)
Social media	40 (16.5%)	20 (12.1%)	4 (1.7%) (*)	9 (5.4%) (*)
Television	27 (11.2%)	16 (9.6%)	22 (9.1%)	25 (15.1%)
Government health agencies	9 (3.7%) (*)	21 (12.7%) (*)	135 (55.8%) (*)	115 (69.3%) (*)
Radio	5 (2.1%) (*)	13 (7.8%) (*)	20 (8.3%)	19 (11.5%)
Cancer organizations	7 (2.9%)	9 (5.4%)	129 (53.3%) (*)	110 (66.3%) (*)
Religious organizations and leaders	0 (0.0%)	1 (0.6%)	11 (4.6%)	14 (8.4%)

(*) Significant difference found in having gotten information from the source or indicating a lot of trust in the source of information between those who have and have not initiated the HPV vaccine series for their adolescent ($p < 0.05$).

the vaccine from information in Vietnamese as opposed to English because it is too difficult to read in English and not everyone here knows English" (#25, male adolescent, not initiated series). Another claimed: "Many Vietnamese do not know about the vaccine, because many mothers cannot speak English and their children do not pay attention to the vaccine" (#21, male adolescent, not initiated series).

Several emphasized that in the U.S. Vietnamese community, there was a misconception that the HPV vaccine is only for females, partly due to sources translating the vaccine as "the cervical cancer prevention" vaccine in Vietnamese (*vắc xin ngừa ung thư cổ tử cung*). A participant said: "Vietnamese people do not understand about the vaccine being needed for boys. When people hear about the word cervix, they will automatically

Table 3
Rating of message effectiveness in persuading a parent to get the HPV vaccine (ranked in order of most rated as "very to extremely effective").

Message	Slightly effective, moderately effective, or I do not know	Very to extremely effective
	N (%)	N (%)
HPV vaccine has been carefully studied by medical and scientific experts. HPV vaccine has been shown to be very effective and very safe. Like other shots, most side effects are mild, primarily pain or redness in the arm. This should go away quickly, and HPV vaccine has not been associated with any long-term side effects. Since 2006, about 57 million doses of HPV vaccine have been distributed in the U.S., and in the years of HPV vaccine safety studies and monitoring, no serious safety concerns have been identified.	103 (25.3%)	305 (74.7%)
I strongly believe in the importance of this cancer-preventing vaccine, and I have given the HPV vaccine to my child. Experts (like the American Academy of Pediatrics, cancer doctors, and the CDC) also agree that this vaccine is very important for your child.	130 (31.9%)	278 (68.1%)
We're vaccinating today so your child will have the best protection possible long before the start of any kind of sexual activity. We vaccinate people well before they are exposed to an infection, as is the case with measles and the other recommended childhood vaccines. Similarly, we want to vaccinate children well before they get exposed to HPV.	132 (32.3%)	276 (67.7%)
HPV vaccine is very important because it prevents cancer. I want your child to be protected from cancer. That's why I'm recommending that your child receives the first dose of HPV vaccine today.	134 (32.8%)	274 (67.2%)
HPV is so common that almost everyone will be infected at some point. It is estimated that 79 million Americans are currently infected, with 14 million new HPV infections each year. Most people infected will never know. So even if your child waits until marriage to have sex, or only has one partner in the future, your child could still be exposed if your child's partner has been exposed.	147 (36.0%)	261 (64.0%)
Your child can get anal/cervical cancer as an adult, but you can stop that right now. The HPV vaccine prevents most anal/cervical cancers.	156 (38.2%)	252 (61.8%)
There will be many things in your child's life that you can't control. But you can control whether your child gets some dangerous kinds of HPV.	161 (39.5%)	247 (60.5%)
Research has shown that getting the HPV vaccine does not make kids more likely to be sexually active or start having sex at a younger age.	211 (51.7%)	197 (48.3%)
My child has gotten the HPV vaccine. Your child should, too.	253 (62.0%)	155 (38.0%)

think about women in their minds as men do not have a cervix" (#07, female adolescent, completed series). Participants stressed the importance of correcting this misconception among U.S. Vietnamese parents.

A few participants wanted information on the effects of the HPV vaccine on Vietnamese adolescents. A participant stated: "My son is Vietnamese, so he will hit puberty later than his American peers. American teenagers start dating at 14 or 15, whereas my son could turn 20 and still be quite inexperienced. So, you should mention the biological age as well as the age appropriate for Vietnamese children… Would this vaccine work if my son still appears like a child at age 15? Maybe Vietnamese kids should get this vaccine later" (#17, male adolescent, initiated but not completed series). Another asked: "Asian adolescents may start puberty later. Do Asians suffer different from the vaccine's side effects? If the website provided such information, I would find it very useful" (#23, male adolescent, not initiated series).

3.3.3. Dissemination of information about HPV vaccination to U.S. Vietnamese parents via social media platforms may be useful, but also raises questions about credibility and trustworthiness

The majority of participants discussed how social media can be useful for disseminating information about HPV vaccination to U.S. Vietnamese parents given the popularity of these platforms in the community. A participant stated: "People like me use social media a lot. Facebook is the most popular. It's easier to reach us through social media" (#17, male adolescent, initiated but not completed series). Another said: "Vietnamese parents like me… many are a big fan of

Table 4
Rating of messages as "very to extremely effective" in relation to adolescent HPV vaccine initiation status (ranked in order of most rated as "very to extremely effective" by parents of unvaccinated adolescents).

Message	Vaccine initiation – No N = 242	Vaccine initiation – Yes N = 166
	N (%)	N (%)
HPV vaccine has been carefully studied by medical and scientific experts. HPV vaccine has been shown to be very effective and very safe. Like other shots, most side effects are mild, primarily pain or redness in the arm. This should go away quickly, and HPV vaccine has not been associated with any long-term side effects. Since 2006, about 57 million doses of HPV vaccine have been distributed in the U.S., and in the years of HPV vaccine safety studies and monitoring, no serious safety concerns have been identified. (*)	168 (69.4%)	137 (82.5%)
We're vaccinating today so your child will have the best protection possible long before the start of any kind of sexual activity. We vaccinate people well before they are exposed to an infection, as is the case with measles and the other recommended childhood vaccines. Similarly, we want to vaccinate children well before they get exposed to HPV.	156 (64.5%)	120 (72.3%)
HPV vaccine is very important because it prevents cancer. I want your child to be protected from cancer. That's why I'm recommending that your child receives the first dose of HPV vaccine today. (*)	151 (62.4%)	123 (74.1%)
I strongly believe in the importance of this cancer-preventing vaccine, and I have given the HPV vaccine to my child. Experts (like the American Academy of Pediatrics, cancer doctors, and the CDC) also agree that this vaccine is very important for your child. (*)	150 (62.0%)	128 (77.1%)
HPV is so common that almost everyone will be infected at some point. It is estimated that 79 million Americans are currently infected, with 14 million new HPV infections each year. Most people infected will never know. So even if your child waits until marriage to have sex, or only has one partner in the future, your child could still be exposed if your child's partner has been exposed.	146 (60.3%)	115 (69.3%)
Your child can get anal/cervical cancer as an adult, but you can stop that right now. The HPV vaccine prevents most anal/cervical cancers. (*)	139 (57.4%)	113 (68.1%)
There will be many things in your child's life that you can't control. But you can control whether your child gets some dangerous kinds of HPV. (*)	134 (55.4%)	113 (68.1%)
Research has shown that getting the HPV vaccine does not make kids more likely to be sexually active or start having sex at a younger age.	108 (44.6%)	89 (53.6%)
My child has gotten the HPV vaccine. Your child should, too. (*)	82 (33.9%)	73 (44.0%)

(*) Significant difference found in rating message as "very to extremely effective" between those who have and have not initiated the HPV vaccine series for their adolescent ($p < 0.05$)

Facebook. I think Facebook is one of the effective channels for reaching out" (#26, female adolescent, completed series).

However, some participants also expressed concerns about the trustworthiness of health information disseminated via social media. For example, a participant expressed "You can't draw conclusions from things you read on Facebook. You can only use them for reference" (#06, male adolescent, initiated but not completed series). Several participants discussed what constituted the credibility of messengers sharing information about the HPV vaccine. For example, a participant said, "Within a Facebook group, if the person sharing the information [about the HPV vaccine] has the expertise, for example if they're a physician working in a hospital, then I'd trust that information more" (#02, male adolescent, not initiated series).

3.3.4. Governments agencies, public health organizations, universities, and hospitals are trustworthy sources of information about HPV vaccination

In addition, the majority of participants identified government agencies, public health organizations, universities, and hospitals as trustworthy sources of information about the HPV vaccine. A participant said, "I feel secure when I read and see references, for example, from reputable research schools or from the government" (#05, male adolescent, completed series). Another mentioned, "Information should be cited from governmental health agencies… the information from those sources is reliable" (#28, female adolescent, completed series).

3.4. Mixed-methods integration of quantitative and qualitative data

Through Table 5, we provide a joint display that integrates several quantitative and qualitative findings of this mixed methods study. Qualitative findings confirmed qualitative results regarding the most trusted sources of information around HPV vaccination (e.g., healthcare providers, hospitals, government health agencies, or public health and cancer organizations). In addition, qualitative findings expanded quantitative results regarding effective and desired message content around HPV vaccination. Qualitative findings also revealed the need for messages to be in the Vietnamese language and for messages to address common cultural concerns about the HPV vaccine. Finally, we found a discordance between quantitative and qualitative findings about whether U.S. Vietnamese parents would trust information about the HPV vaccine that is disseminated through social media. While survey data suggested low trust in HPV vaccination information from social media, the majority of interview participants recommended social media for education and outreach.

4. Discussion and conclusion

4.1. Discussion

This mixed-methods study generated new information about strategies to promote HPV vaccination among the U.S. Vietnamese population, who bears a high burden of HPV-related cancers and has a low rate of HPV vaccine uptake. Our main findings provide key insights into trusted sources of information, perceived effectiveness of motivational messages, and preferred educational content regarding adolescent HPV vaccination among parents. These results can inform the design and implementation of culturally-relevant interventions to increase U.S. Vietnamese parents' HPV vaccine uptake for their adolescents.

U.S. Vietnamese parents identified healthcare providers, hospitals, government health agencies, or public health and cancer organizations as credible sources of information about HPV vaccination. They emphasized the importance of referencing these credible sources in intervention materials. Our finding about high trust in providers regarding HPV vaccine information is consistent with existing research with Asian Americans [43-46]. However, unlike other Asian origin groups, social networks (e.g., family, relatives, colleagues, or community peers) [43,47,48] did not emerge as a

Table 5
Joint display for mixed methods integration of quantitative and qualitative findings.

Topics	Quantitative survey results	Qualitative interview results	Meta-inferences and implications for intervention development
Most trusted sources of information around HPV vaccination	Survey participants indicated a lot of trust in information about HPV or the HPV vaccine from doctors or other healthcare providers (77.2%), government health agencies (61.3%), and cancer organizations (58.6%).	Several interview participants mentioned that credible messengers and sources of information about HPV vaccination included physicians, U.S. hospitals, government agencies, public health organizations, and research institutes.	***Confirmatory*** Qualitative findings confirmed qualitative results that Vietnamese parents indicated high trust in information about HPV vaccination from healthcare providers, hospitals, government health agencies, or public health and cancer organizations. Interventions should reference evidence-based information from these sources.
Effective message content around HPV vaccination	Messages most commonly rated as very to extremely effective for persuading a parent to get the vaccine emphasized the safety of the HPV vaccine (74.7%), experts' endorsement of the HPV vaccine (68.1%), the importance of HPV vaccination prior to HPV exposure via sexual activity (67.7%), and the cancer prevention benefits of HPV vaccination (67.2%).	The majority of interview participants wanted to know about the safety and possible side effects of the HPV vaccine. Most participants voiced the desire to learn about the effectiveness of the HPV vaccine, cancers and diseases prevented by the vaccine, eligibility for vaccination (e.g., age, sex), number of required doses, costs, and access to the vaccine. Several discussed the need for health education information to be in the Vietnamese language. Participants also wanted information addressing common cultural concerns that Vietnamese parents had about HPV vaccine.	***Expansion*** Quantitative results showed that effective messages emphasized the safety of the HPV vaccine, experts' endorsement of the HPV vaccine, the importance of HPV vaccination prior to HPV exposure via sexual activity, and cancers prevented by the vaccine. Qualitative results expanded quantitative results to show that Vietnamese parents desired information in the Vietnamese language. Topics parents wanted to learn about include eligibility and number of required doses, costs, and access. Attention needs to be paid to addressing common concerns about the HPV vaccine among Vietnamese parents, such as effectiveness or potential side effects specific to Vietnamese adolescents or whether parents should delay HPV vaccination for Vietnamese adolescents.
Dissemination of evidence-based information about HPV vaccination via social media	While 14.7% of survey participants reported having gotten information about HPV vaccination via social media, only 3.2% indicated a lot of trust in information about HPV vaccination via social media.	The majority of interview participants discussed how social media can be a useful tool to disseminate information about HPV vaccination to U.S. Vietnamese parents given the popularity of these platforms in the community. However, some participants also expressed concerns about the trustworthiness of health information disseminated via social media.	***Discordance*** Quantitative and qualitative findings were incongruent about whether U.S. Vietnamese parents would trust information about HPV vaccination that was disseminated through social media.

popular trusted source of HPV vaccine information in this study. Furthermore, several previous studies found that parents or caregivers from other racial and ethnic groups describe low or deteriorated trust in government and national health agencies as a source of HPV vaccine information [10,49]. These results suggest the need to consider preferences for health information sources that may be unique to U.S. Vietnamese (as opposed to a one-size-fits-all approach to interventions). Unfortunately, fewer than half of the survey participants indicated having gotten information about HPV vaccination from providers, and very few had gotten information from government agencies or cancer organizations (7% and 4%, respectively). This finding indicates poor reach of current information dissemination efforts about HPV vaccination, particularly from government agencies and cancer organizations, to the U.S. Vietnamese population.

We found mixed support for the use of social media for disseminating evidence-based information about HPV vaccination. The majority of interview participants indicated that social media can be effective for reaching the target U.S. Vietnamese audience. However, for some interview participants, the dissemination of information about HPV vaccination to U.S. Vietnamese parents also raises concerns about credibility and trustworthiness. Interestingly, only 3% of survey participants indicated a lot of trust in HPV vaccine information from social media.

Previous research has documented the spread of HPV vaccine misinformation or conspiracy theories on social media [50], which have certainly been exacerbated by the COVID-19 pandemic [51]. A recent systematic review found that some social media-assisted HPV vaccine interventions were effective in improving knowledge, but did not have significant impacts on vaccine intentions and uptake [52]. While some research emphasizes that social media can be useful for sharing personal narratives and learning about other parents' experiences with HPV vaccination [53], a study highlights how individuals tend to trust cancer-related or HPV-related Facebook posts originating from government agencies and health organizations more than those from individuals [54]. Further research is warranted to explore how to best utilize social media for HPV vaccine interventions for the U.S. Vietnamese population. For example, it may be more effective to use social media as a recruitment tool for digital interventions [55-57] rather than relying on social media as an interventional platform for disseminating information.

The majority of interview participants expressed a desire to learn more about the safety and possible side effects of the HPV vaccine. In our survey, highest proportions of parents of both unvaccinated and vaccinated adolescents rated the message that the HPV vaccine has “no serious safety concerns” as highly effective. Interestingly, our finding contrasts with a previous study with English-speaking parents of adolescents, where the statement of “no serious side effects” of HPV vaccination elicited negative reactions and was perceived as ambiguous and lacking in transparency [58]. While not focused specifically on U.S. Vietnamese, a recent national study shows that safety concerns or adverse effects have become a growing reason for HPV vaccine refusal in the U.S., increasing from 5% in 2008 to 13% in 2019 [59]. Future studies should explore effective approaches to presenting safety and side effects information to Vietnamese parents to increase trustworthiness and allay fears.

Relatedly, interview participants raised information needs *specific to* Vietnamese adolescents; they requested information on the following topics: potential side effects, HPV vaccine effectiveness, and whether parents should delay the vaccine given the belief that Vietnamese adolescents may enter puberty later than their American counterparts. Our previous research also identified that 39% of U.S. Vietnamese parents with unvaccinated adolescents believed their adolescents were too young for a sexually transmitted disease-preventing vaccine [7]. Together, these findings make significant contributions to knowledge about culture-specific beliefs or concerns around HPV vaccination.

Study participants highlighted the need for health education to be in the Vietnamese language and were receptive to a web-based platform that could disseminate information about the HPV vaccine. In addition to information describing safety and side effects and targeting culture-specific beliefs, effective intervention messages would emphasize medical experts' endorsement of the HPV vaccine, the importance of HPV vaccination prior to HPV exposure via sexual activity, and the cancer prevention benefits of HPV vaccination. Additional educational content would include age eligibility for vaccination (e.g., at what age, vaccination for males and females), number of required doses, costs, and access to the vaccine.

Our study may have limitations in terms of the transferability of results to different contexts. The majority of parents had relatively high incomes and education, and the findings may not be representative of Vietnamese parents with lower socioeconomic status. In addition, we did not assess the temporal relationship between messages about HPV vaccination and actual HPV vaccination status, which prevents us from understanding whether more favorable rating of a message was a result of a prior experience of vaccination or a predictor of future HPV vaccine uptake. While we only assessed parents' perspectives, future research can benefit from exploring the perspectives of clinic staff and providers serving U.S. Vietnamese.

4.2. Innovation

Our study is innovative in several ways. We focus on a high-risk population that both bears a high burden of HPV-related cancers and has a low rate of HPV vaccine uptake. Moreover, past research with U.S. Vietnamese populations primarily studied HPV vaccination among U.S. Vietnamese females [60-64]. We are not aware of publications that have included U.S. Vietnamese parents with male adolescents. In contrast, our research is novel as it examines perspectives of U.S. Vietnamese parents of both male and female adolescents.

We innovatively integrated mixed-methods data at multiple levels: study design, methods, and interpretation and reporting [42]. We 1) used an explanatory sequential mixed-methods design, 2) linked the data sources together through sampling and merged them for analysis, and 3) provided a joint display to explain how one data source confirmed, expanded, or diverged from the other [42]. Our integration enhances the transparency of the data analytic process and enriches the interpretation and validity of study findings.

To our knowledge, our study is the first to recruit Vietnamese parents residing across the entire U.S. and inquire about their attitudes, beliefs, and uptake regarding HPV vaccination. Unlike previous studies that focused on specific geographic regions, our research included a diverse participant pool consisting of 408 survey respondents from 36 U.S. states and territories [7]. This wide geographic representation significantly enhances the external validity of our findings, allowing for a more comprehensive understanding of the perspectives and experiences of U.S. Vietnamese parents regarding HPV vaccination. Our study also contributes to the literature by identifying specific cultural concerns and information needs that U.S. Vietnamese parents had regarding HPV vaccination for their adolescents. Additional innovation included the recruitment of both Vietnamese-speaking and English-speaking U.S. Vietnamese parents from diverse sources (e.g., community-based organizations, Facebook groups), the incorporation of several validated survey measurements, and the use of a rigorous translation process for survey instruments, interview guide, and interview transcripts.

5. Conclusion

Using a mixed-methods design, our study assessed trusted sources of information, perceived effectiveness of messages, and preferred educational content about adolescent HPV vaccination among U.S. Vietnamese parents. Results demonstrate the need to consider health preferences and culture-specific beliefs around HPV vaccination in this population. We identified credible messengers, feasible strategies, and elements of impactful messages for interventions to increase U.S. Vietnamese parents' uptake of HPV vaccination for their adolescents. Our findings can inform the development and implementation of culturally-relevant interventions to address low adolescent HPV vaccine uptake in this high-risk, underserved population, ultimately reducing HPV-related cancer disparities and improving health equity.

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The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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Appendix A. Supplementary data

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