



# HPV vaccine delay and refusal among unvaccinated Mexican American young adult women: a qualitative investigation of Mexican-born and US-born HPV vaccine decision narratives

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**Abstract** Low HPV vaccination rates among Latina young adults perpetuate HPV-associated cancer disparities. Using qualitative methods, this study explored individual, interpersonal, and community factors that influence HPV vaccine delay and refusal among Mexican- and U.S.-born Mexican American young adult women. Participants ( $N=30$ ) between 18 and 26 years old were purposively sampled from two federally qualified health centers in Orange County, California. The National Institute on Minority Health and Health Disparities research framework and narrative engagement theory guided semi-structured phone interviews coded inductively and deductively. Participants primarily attributed vaccine status to individual and interpersonal reasons. Emerging themes included low HPV vaccine knowledge, insufficient provider communication, negative perceptions about HPV and the vaccine, motherhood responsibilities,

mother's communication about HPV, cultural family norms, health care access, and misinformation. Compared to U.S.-born Latinas, Mexican-born participants more frequently expressed avoiding health care discussions with family. HPV vaccine recommendations for young Mexican American women should include socioculturally tailored messages that may improve HPV vaccination acceptance and uptake.

**Keywords** HPV vaccine · Latina cancer disparities · Health equity · Nativity · Narrative engagement

## Introduction

In the U.S., it is estimated that more than 90% of cervical cancer cases are attributable to HPV infections (Saraiya et al., 2015). Cervical cancer incidence rates disproportionately affect minority women, with Latina women most impacted (Jemal et al., 2013; Viens et al., 2016). Between 2008 and 2012, the cervical cancer rate of Latinas was 9.7 per 100,000 individuals, compared to 7.1 among non-Latinas (Veins et al., 2016).

Latinos comprise nearly 19% of the U.S. population but account for 39.4% of the population in California, where approximately 27% of the population was born outside the U.S. (U.S. Census Bureau, 2019). Mexican American (MA) residents account for 63% of California Latinos (Flores, 2017). The cervical cancer incidence rate among Latina women in Orange County, California between 2014 and 2018 was 8.8 per 100,000, much higher compared to their non-Latina White (5.6 per 100,000) counterparts (Conduent Healthy Communities Institute, 2021).

Latinas have higher rates of cervical cancer compared to non-Latinas which can be offset by increased vaccination and screening (Siegel et al., 2015). In 2016, the HPV vaccine

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initiation rate among young adult Latinas was 44.7%, compared to 52.2% among non-Latina Whites (Centers for Disease Control & Prevention, 2018). However, U.S.-born Latina young adults have higher HPV vaccination initiation (29.5% vs. 13.7%, respectively) and completion (18.5% vs. 7.2%) rates compared with non-U.S.-born Latina young adults (Pérez et al., 2018). Such findings suggest non-U.S.-born Latinas may be at greater risk of HPV infection than their U.S.-born counterparts. How Latinas acquire and process information about HPV will likely provide insight into how HPV-related health messages can be culturally adapted to effectively reach non-U.S.-born Latinas. To promote health equity and effectively reach MA women, we elicited their vaccine delay and refusal stories by nativity status to uncover potential messaging strategies.

Narrative engagement theory (NET), a communication theory, has been proposed as a promising approach to promote health equity and uncover authentic decision narratives (Hopfer et al., 2017; Miller-Day & Hecht, 2013). NET has been used to elicit personal HPV vaccine decision stories (Hopfer & Clippard, 2011; Hopfer et al., 2017) and shape culturally resonant interventions for college women that nearly doubled vaccination in a randomized controlled trial (Hopfer, 2012). An authentic decision story approach may result in greater engagement in the competitive message environment. Narrative communication approaches may have greater advantage over didactic approaches in reaching resistant and low-awareness subgroups (Miller-Day, 2008). Furthermore, the National Cancer Institute's cancer prevention community has emphasized the importance of including and exploring the concerns of racial and ethnic minoritized subgroups like MA women for improved cancer prevention (Srinivasan et al., 2015).

Clinicians and Latina patients have attributed individual (e.g., low HPV knowledge, trust in sexual partner), interpersonal (mother–daughter communication, cultural norms), and community (e.g., health insurance, clinic wait time) factors to HPV vaccine delay and refusal (Hopfer et al., 2017; Peterson et al., 2020). An ecological health communication approach that accounts for multiple contexts beyond the individual level to understand health behavior may therefore advance theory, research, and practice regarding health behaviors (Moran et al., 2016) and potentially indicate how to effectively increase HPV vaccination among MA women. Understanding how MA young adult women receive HPV information, to whom they speak about HPV vaccinations, and how they ascribe meaning to vaccine messages may better inform patient–provider interactions and provide a foundation for the design of effective clinical interventions. The National Institute on Minority Health and Health Disparities (NIMHD) research framework offers a multilevel approach to understanding drivers of health disparities (Alvidrez et al., 2019). The NIMHD research framework recommends health

disparities research across different domains (individual, interpersonal, community, and societal) and levels of influence (biological, behavioral, physical and built environment, sociocultural environment, and health care system). This study used NET to understand the full context of HPV vaccine delay and refusal decisions among participants and the NIMHD research framework to guide exploration of multi-level influences (i.e., individual, interpersonal, community) on decision making.

This study sought to understand HPV vaccine delay and refusal narratives among MA young patients from federally qualified health centers (FQHCs) in Orange County, California. The objective was to investigate what HPV messages unvaccinated MA patients receive and relay to others at the individual, interpersonal, and community levels; how they ascribe meaning to these messages; and how these messages affected their intentions to vaccinate.

## Methods

### Participants and recruitment procedures

Between March and August 2021, we purposively sampled 15 unvaccinated Mexican-born and 15 unvaccinated U.S.-born MA women from two FQHCs to participate in semi-structured interviews. Sample size was determined by past work that suggested adequate saturation (Onwuegbuzie & Leech, 2007). From a compiled list of potentially eligible patients, a bilingual–bicultural researcher (primary author), not affiliated with the clinics, contacted patients by email (up to twice) and phone (up to three times). Latina subgroup data were not collected by the clinic and needed to be confirmed by the research staff at time of recruitment. Emails were sent to 50 potential participants at a time, notifying them of the study, eligibility criteria, and that a researcher would contact them in the next few weeks to inquire about their interest to participate. Researchers followed up via phone to recruit potential participants. Voicemails were left if a participant did not pick up the phone. Recruitment continued until Mexican- and U.S.-born MA targets were reached.

Eligibility criteria included being female, aged 18 to 26 at the time of the interview, self-identify as MA, lived in California for the past 3 years, offered the HPV vaccine by a provider in adulthood (18 years or older), and not yet initiated the HPV vaccine. Exclusion criteria included being unaware of their vaccine status and having never heard of HPV or the vaccine. The bilingual–bicultural researcher recruited potential participants in English and Spanish. Participants chose their preferred language of the interview; all interviews were conducted in English or mostly English. All study procedures were approved by the University of California, Irvine (UCI) Institutional Review Board prior to the study.

A total of 1520 unvaccinated Latina patients between 18 and 26 years old were identified via electronic medical records and 365 were contacted via telephone or email. Seventeen percent ( $n=63$ ) of telephone numbers were not working, no longer in service, or indicated a wrong number, and 4% of emails bounced back ( $n=15$ ). Of the 365 participants, 29% ( $n=107$ ) were reached by phone and the remainder did not respond to phone messages or emails. Approximately 28% ( $n=30$ ) were included in this study; 3% ( $n=3$ ) did not identify as MA, 15% ( $n=16$ ) received at least one dose of the HPV vaccine, 2% ( $n=2$ ) did not fall into the age category at the time of interview, 21% ( $n=22$ ) could not be reached at the time of their scheduled interview, and 35% ( $n=34$ ) declined to participate.

### Interview procedures and interview guide development

At the time of the phone interviews, participants were again screened for eligibility and received a study information sheet via email. The interview staff member reviewed the information sheet with participants by telephone, answered questions, and obtained verbal consent to participate. Telephone interviews spanned approximately 30–45 min in length and were audio recorded. Participants selected a \$20 Target or Walmart e-gift card as compensation.

The semistructured interview guide was developed to elicit HPV vaccine decision narratives using narrative inquiry techniques (Clandinin, 2006). Questions were formulated to investigate how MA women describe when (circumstances, context) they were recommended the HPV vaccination, what they thought about it, and why they declined. Probes were used to clarify vague responses and reflect on HPV-related conversations, what they thought about those conversations, and how they ascribed meaning to the vaccine messages they received. A second theoretical framework, the NIMHD research framework (Alvidrez et al., 2019), also informed the focus of interview questions; this framework informed exploration of multilevel factors that may have shaped MA women's HPV vaccine perceptions and attitudes. For example, the interview guide included open-ended questions exploring individual (i.e., knowledge, perceptions, provider trust, cultural and religious beliefs), interpersonal (i.e., family support or opposition, provider communication, cultural norms), and community (i.e., availability of health services, clinic experiences, wait times, exposure to negative HPV vaccine messages) factors associated with their HPV beliefs and decisions. Demographic information collected included participant age, whether currently sexually active, number of children, employment, number of years they had lived in the U.S. (if Mexican-born), health insurance, race, and vaccination status regarding additional vaccines (e.g., flu, Tdap, Covid-19).

### Data analysis

Surveys were analyzed using descriptive statistics including frequencies and means for all sociodemographic data via SPSS version 27.

Audio recordings of the interviews were transcribed, manually verified, and deidentified. Two coders (first and second author) then participated in the qualitative phonetic iterative approach (Tracy, 2019b). This approach refers to alternating between coding the data inductively for emergent ideas and deductively coding the data for theory-guided individual, interpersonal, and community factors relating to HPV vaccine delay and refusal. Inductive and deductive coding was revisited to understand how participants ascribe meaning to these experiences at multiple levels and how these factors ultimately affected their vaccination decisions. Primary data analysis consisted of line-by-line coding of the transcripts, tagging factors that they attributed to their vaccine decisions, and developing a codebook with these descriptive codes (Tracy, 2019a). Data were then organized into higher-order codes, interpretative themes of individual, interpersonal, and community levels that influenced HPV decisions (Tracy, 2019a). Coders convened to discuss themes selected a priori from the NIMHD research framework and those that emerged from interviews, select quotes, organize results, and resolve discrepancies. Coders used a shared drive of transcripts and field notes stored in Word and a codebook in Excel to organize codes, select quotes, and assemble themes.

## Results

### Demographics

The average age of participants was  $23 \pm 1.77$  years. Most participants were mothers, currently sexually active, employed at least part time, and had health insurance at the time of the interview. Mexican-born participants lived in the U.S. an average of 16 years ( $SD=5.5$ ). See Table 1 for additional demographic information by nativity status.

### Themes

Table 2 provides example quotes, organized by nativity status, that represent individual, interpersonal, and community level factors that contributed to HPV vaccine delay and refusal.

#### Individual

Individual-level themes included women's low HPV vaccine knowledge levels, negative vaccine perceptions, and how motherhood has affected their HPV vaccine intentions.

**Table 1** Participant demographic characteristics

	Unvaccinated Mexican-born ( <i>n</i> = 15) <i>M</i> ± <i>SD</i> or <i>n</i> (%)	Unvaccinated U.S. -born ( <i>n</i> = 15) <i>M</i> ± <i>SD</i> or <i>n</i> (%)	Total Mexican American ( <i>N</i> = 30) <i>M</i> ± <i>SD</i> or <i>n</i> (%)
Age (years)	23 ± 2.0	24 ± 1.5	23 ± 1.77
Covid vaccination status			
One or more	10 (66.7)	3 (20.0)	13 (43.3)
Intend to receive	2 (13.3)	5 (33.3)	7 (23.3)
Don't intend to receive	3 (20.0)	7 (46.7)	10 (33.3)
Received childhood vaccinations (Tdap)	14 (93.3)	15 (100.0)	29 (96.7)
Typically receives flu vaccine	10 (66.7)	9 (60.0)	19 (63.3)
Currently sexually active	12 (80.0)	11 (73.3)	23 (76.7)
Condom use	5 (33.3)	5 (33.3)	10 (33.3)
Health insurance	13 (86.7)	15 (100.0)	28 (93.3)
Employment			
Not employed	7 (46.7)	5 (33.3)	12 (40.0)
Part-time	2 (13.3)	5 (33.3)	7 (23.3)
Full-time	6 (40.0)	5 (33.3)	11 (36.7)
Has children	10 (66.7)	10 (66.7)	20 (66.7)
Currently single (not in a relationship)	5 (33.3)	7 (46.7)	12 (40.0)
Years in U.S	16 (5.5)	–	–

**HPV vaccine knowledge** Most women, regardless of nativity status, attributed their primary reason for not being vaccinated to low knowledge about the need for or purpose of the HPV vaccine. Unlike childhood vaccines, many participants associated the HPV vaccine with a sexually reproductive service (e.g., birth control) and wanted to be better informed about the vaccine, including what it protects against and the potential side effects.

It's very much education. I'm not opposed to it [HPV vaccine], as far as like religion or any of that, but just want to be well aware of what it is. Why we should get it? You know? How would it affect us? Like, the good and bad. But I don't think I feel well educated about it to know like, oh, OK, that's something that I do want to do. But like anything, right? As far as like, you want to be educated on birth control, you want to be educated on other things. (Mexican-born participant)

Some women blamed themselves for their lack of initiative to better understand the vaccine. Others attributed their lack of knowledge to rushed health care visits.

**HPV vaccine perceptions** Mexican- and U.S.-born MA women expressed fear of the vaccine. Pain of injections and adverse reactions were primary concerns. Unknown side effects were viewed as “too risky” for participants to opt into receiving the HPV vaccine. A few women viewed the HPV vaccine as not needed based on their sexual activity status (e.g., abstinence, monogamous relationship). Some

unvaccinated U.S.-born women talked about trusting their body's immune system to fight off infections. For these women, preference for natural over vaccine immunity prevailed. Other participants expressed lack of trust in the vaccine and consequences of taking an unknown substance. Some women talked about provider mistrust and vaccine mistrust messages they heard as a child.

**Motherhood** Motherhood also influenced HPV vaccine accessibility and perceptions. Women devoted most health care visits to their children rather than themselves. Most Mexican- and U.S.-born participants in this study were mothers and communicated that most health care visits were for their child, leaving less time to fulfill their own health care needs. Although some women viewed the HPV vaccine as a low priority, motherhood also played an important role in health care choices for participants. One new mother wanted to get the HPV vaccine soon to ensure she is around long enough to take care of her child.

I think now that I am an adult with a child, my opinion has changed a lot in a lot of ways. Like, I appreciate the services provided by the state. I grew up with a lot of women that took care of themselves, and I didn't realize how important it is. Now, if I got it [HPV vaccine] offered at a clinic, I would say yes because I feel more responsible for my own health. I started carrying about myself more because it's not all about me anymore. It's about him [son], too. And my health is his ... how he

**Table 2** Quotes from qualitative interviews from unvaccinated Mexican American young adult women by theme and nativity status

Mexican-Born	U.S.-Born
<b>Individual</b>	
<p><i>Knowledge</i></p> <p>It's very much education. I'm not opposed to it [HPV vaccine], as far as like religion or any of that, but just want to be well aware of what it is. Why we should get it? You know? How would it affect us? Like, the good and bad. But I don't think I feel well educated about it to know like, oh, OK, that's something that I do want to do. But like anything, right? As far as like, you want to be educated on birth control, you want to be educated on other things</p>	<p><i>Perceptions</i></p> <p>I don't really like vaccines. ... I believe like, even if you get the vaccine or whatever, your body is already immune to it. So, I don't really think vaccines will help you prevent any type of disease. I'm scared of the pain. I'm not really an injection [person], so I start freaking out I haven't had sex. I don't see the need of needing it. It's a good thing to have to protect against cervical cancer and all that, but as of now, I don't need it because I'm not active</p>
<p><i>Motherhood</i></p> <p>I want to know how it benefits me or how will it benefit my children. I would want to know more information about that</p>	<p>I trust my body. To be honest, I don't feel comfortable having it [HPV vaccine] in my body. I feel like I don't need it. I'm not even active [sexually] like that. I don't want to put something in my body if I don't know how it's going to affect me. I'd rather not risk it. I'm actually kind of scared to even do it</p> <p><i>Motherhood</i></p> <p>I think now that I am an adult with a child, my opinion has changed a lot in a lot of ways. Like, I appreciate the services provided by the state. I grew up with a lot of women that took care of themselves, and I didn't realize how important it is. Now, if I got it [HPV vaccine] offered at a clinic, I would say yes because I feel more responsible for my own health. I started carrying about myself more because it's not all about me anymore. It's about him [son], too. And my health is his ... how he thrives in his life. I definitely think my thoughts have changed because of him</p> <p>The first time I heard about it [HPV virus] was when I was pregnant with my first pregnancy. I didn't know what HPV was, to be honest. They just said that it's something that happens. I didn't hear about the vaccine [HPV] until I was pregnant with my second. I was supposed to get it after I delivered, but I totally forgot about it. They were just trying to get me in and out. It's hard because I did get pregnant back-to-back</p>

**Table 2** (continued)

Mexican-Born	U.S.-Born
<b>Interpersonal</b>	
<i>Quality provider communication</i>	
<p>It usually never really goes into something very in depth, you know. It's very much like, when I go to a new place, it's like, "Oh, we noticed you haven't gotten it, would you like to get it today?" And that's kind of what it is. It never, ever really goes into like, "Oh, this is what it will do, this is what it will cause, this is why you would be getting it." And my experience at UCI has mainly been for another issue that I've been dealing with for a long time. So honestly, when it was offered to me at UCI, it was just not my priority. And I also did not ask, nor was it explained to me what it what it really does, you know?</p>	<p><i>Quality provider communication</i></p> <p>I've heard the statistics and all that. But I've never really had anybody really push me to do so [vaccinate for HPV]</p> <p>The first time I was offered the HPV vaccine, I just said no, because I didn't understand what the doctor said. Some of the terms I didn't understand, and she just spoke brief about it. I was shy at the time, too shy to ask any questions. I saw her [provider] in a hurry, and I was like, "Oh yeah, I understand," but in reality, I didn't. I just said that because she seemed in a hurry</p>
<p>I feel like with Hispanic women, we don't go to the doctor until it's something really bad. And I feel like clinics just push a lot on us. Clinics should provide more on how to inform women on how to take care of them in advance. So, we can take some time to think about it and it's not offered in the moment. Sometimes we need a little more information and a little more explanation</p>	<p>[referring to how she prefers to learn more about HPV] I really like when they hear you out and they try to explain certain things. That feeling that you get, when you ask a question, it's not a dumb question, and they take their time. You honestly see when something is genuine and when something is rushed. When they just try to get you in and get you out and see the next patient. When you can see why they got into being a doctor, that hospitality care they give to their patients</p>
<i>Mother–daughter communication</i>	
<p>My mom is very skeptical of vaccines and stuff like that. She thinks home remedies and stuff like that help. Sometimes she thinks certain home remedies will help me, but I like to listen to my physicians because I know everybody's body is different. There are certain things that may work out for somebody that won't work out for me. I don't really like to communicate with her about my health because she is skeptical about certain things. And my doctors know more about what is going on with my body. And like I said, everybody's body is different</p>	<p><i>Mother–daughter communication</i></p> <p>Somebody needs to explain it well enough and not, like, you know, be rude about it. My mom would want to know all the side effects and stuff like that ... like, if she has any questions, for the doctor or nurse not to get mad for asking a lot of questions</p>
<i>Family and cultural norms</i>	
<p>I think we are very much a united culture. I have friends whose moms won't let them do this, won't let them do that [vaccinate]. It's very much like we want to avoid that conflict, you want to avoid breaking that bond. So, you kind of feel like you have to choose your family. I also have friends whose moms don't want to be on birth control, and so my friends are not on birth control. You know, you just keep it ... to maintain unity and keep the family together, I guess</p> <p>Hispanic parents are often not educated on any of those types of things [vaccines]. I think they don't know much about the topic so they would see it as something negative. Like, oh, you are getting the vaccine because you have something or you did something [sex]. They are not open to talk about those things in our culture</p>	<p><i>Family and cultural norms</i></p> <p>As a Mexican American girl, coming from Mexican parents, I think they ... well, at least mine are, like, scared to get that because they don't know what we are putting into our bodies that are going to affect us later on and how we're gonna react later on. That it's gonna affect us in some way, shape, or form. My parents have never gotten that vaccine. That's why they don't really talk to us about getting vaccinated and things like that. Maybe it's like, fear or later in the future</p> <p>Always growing up I've been told not to trust the doctor and shots and to just pray. I think it's more of the fear and lack of trust. At least in my family, it's all about trusting God and praying that it [cancer] wouldn't happen to you, so just pray. It's too risky [to vaccinate]. I feel like my friends would say the same thing</p> <p>I feel like the younger generation really doesn't get into vaccines and all that just because like our family, like older people didn't get it</p> <p>I think in the Mexican culture, there are some things that are taboo and not discussed. In Mexico, they are raised a different way and they come from a different educational background. In the Mexican culture, there's a lot of misinformation and misunderstanding about a lot of things, and that influences our decision to not vaccinate for HPV. Things like sex and birth control are topics that are hard to bring up. I couldn't talk about those things in high school like I can now with my mom because I was a minor at the time</p>
<b>Community</b>	
<i>Access to quality care and adverse health care encounters</i>	
<p>Honestly, it has been the best experience I've had so far dealing with medical care in my adulthood. [on booking an appointment] I think it's not as convenient because of how things are right now. So, it's very hard to get an appointment. I have to book a little bit over a month in advance It's harder with insurance. There's certain insurances clinics won't take. So, it's really inconvenient. You need to call the insurance to change the provider. That's one of the hardest things. You have to double check what can accept what insurances</p>	<p><i>Access to quality care and adverse health care encounters</i></p> <p>[regarding rude staff] At one point, I had questions [about HPV]. But I was like, nah, forget it. I felt uncomfortable asking them</p>
<i>Misinformation</i>	
<p>I guess in the Latina community, we don't really talk about those things [HPV], which it shouldn't be like that. There's myths about; if you get this vaccine, you might get this or that. They always come up with myths. Like right now, with the coronavirus one, if you get it, you're gonna die</p>	<p><i>Misinformation</i></p> <p>I've heard something negative about it. It gives you cancer later in life [HPV vaccine]</p>

thrives in his life. I definitely think my thoughts have changed because of him. (U.S.-born participant)

By contrast, another mother mentioned she was afraid if she got vaccinated against HPV, she would be unable to provide a blood transfusion should her child need one. Many women cited their pregnancy status and planned pregnancy as a reason why they have declined or delayed vaccinating against HPV. Because the HPV vaccine is not recommended for pregnant women, vaccinating this age group is particularly challenging. Messaging that emphasizes vaccination as important for mothers to live longer and be there for loved ones may more likely resonate with MA women. Health care interventions and messaging targeting young adult MA mothers should urge vaccinations to ensure they protect their health to take care of their children.

### *Interpersonal*

Interpersonal influences included the quality of interactions between women and their health care providers, mothers, and family members.

*Quality provider communication* Many women, regardless of nativity status, recalled conversations with medical providers about HPV that were brief and rushed. Most women identified having adequate knowledge as an important prerequisite before deciding to get vaccinated against HPV. Some participants expressed the desire to have a conversation with their physician before they would feel comfortable receiving the HPV vaccine. One participant acknowledged she did not understand the medical terminology used during a health care visit and avoided asking questions about HPV to avoid inconveniencing her physician, who appeared rushed.

The first time I was offered the HPV vaccine, I just said no, because I didn't understand what the doctor said. Some of the terms I didn't understand, and she just spoke brief about it. I was shy at the time, too shy to ask any questions. I saw her [provider] in a hurry, and I was like, "Oh yeah, I understand," but in reality, I didn't. I just said that because she seemed in a hurry. (U.S.-born participant)

*Mother–daughter relationship* Most participants spoke about their close connection with family, particularly their mother. Home remedies and holistic approaches to health were household traditions passed on from their mothers. Many Mexican-born women cited their parents' views as "too traditional" or "too antiquated," stating their mother's lack of knowledge and openness to sexual and reproductive services were why they choose to not discuss health decisions with her. Mexican-born women often described their mothers' preferences for home remedies and holistic

approaches to health prevention. They also spoke about the need to break away from these traditional cultural views and establish independence and ownership of their health.

My mom is very skeptical of vaccines and stuff like that. She thinks home remedies and stuff like that help. Sometimes she thinks certain home remedies will help me, but I like to listen to my physicians because I know everybody's body is different. There are certain things that may work out for somebody that won't work out for me. I don't really like to communicate with her about my health because she is skeptical about certain things. And my doctors know more about what is going on with my body. And like I said, everybody's body is different. (Mexican-born participant)

In comparison, U.S.-born women more often consulted with their mother on health issues and cited her approval of the HPV vaccine as an important factor needed for them to feel comfortable receiving the vaccine.

*Mexican family cultural norms* Mexican- and U.S.-born women cited familial cultural norms as a challenge to receiving the HPV vaccine. Most viewed the HPV vaccine as a sexual reproductive health service, a subject matter not discussed in MA households, creating lower levels of awareness and opportunities for discussion. Others acknowledged receiving the HPV vaccine may send the wrong message to family members, implying they are sexually active or at risk of a sexually transmitted infection. Other participants reported parents' disapproval and the need to comply with their wishes to maintain strong familial bonds.

I think we are very much a united culture. I have friends whose moms won't let them do this, won't let them do that [vaccinate]. It's very much like we want to avoid that conflict, you want to avoid breaking that bond. So, you kind of feel like you have to choose your family. I also have friends whose moms don't want to be on birth control, and so my friends are not on birth control. You know, you just keep it ... to maintain unity and keep the family together, I guess. (Mexican-born participant)

### *Community*

Community-level influences included access to quality health care and exposure to misinformation through social media and extended networks.

*Access to quality care and adverse health care encounters* Nearly all participants expressed they had positive encounters and high-quality care at the FQHCs. However,



select negative experiences also affected participants' intention to vaccinate. One participant recalled that an encounter with a rude staff member deterred her from feeling comfortable asking questions about HPV. Another patient accepted the HPV vaccine on two occasions but never received the vaccine at the end of her rushed visits. Although most participants reported short wait times to be seen by a physician, some participants acknowledged a change in service delivery since the coronavirus pandemic, with longer wait times and office visits making it less likely they would stay longer for the additional shot. Other participants expressed barriers due to lack of medical coverage, such as when they move residence and change employers.

It's harder with insurance. There's certain insurances clinics won't take. So, it's really inconvenient. You need to call the insurance to change the provider. That's one of the hardest things. You have to double check what can accept what insurances. (Mexican-born participant)

Mexican-born participants often cited inconveniences dealing with insurance claims when navigating their insurance coverage. One participant stated she was willing to deal with this hassle of correcting her insurance paperwork for medically necessary visits but was less likely to do it for a lower priority visit like the HPV vaccine. Mexican-born uninsured participants cited the cost of the HPV vaccine and medical office visits as a barrier to receiving the HPV vaccine. Many Mexican-born women stated they did not utilize health care often in childhood and spoke about the challenges of navigating the health care system for the first time as insured young adults and learning about health services such as the HPV vaccine.

*Misinformation* Some narratives revealed misinformation shaping MA vaccine decisions. For example, one woman described not wanting to vaccinate for fear of not being able to donate blood should her child need a blood transfusion or the vaccine causing cancer. Women who encountered HPV vaccine misinformation referenced learning about this information through social media or friend networks via social media articles or short videos. Women, regardless of nativity status, viewed the HPV vaccine as risky based on exposure to concerns stemming from negative and inaccurate messages. Women exposed to misinformation were highly skeptical of vaccine safety, even if they could not recall the source of the misinformation.

## Discussion

### Individual, interpersonal, and community factors of HPV vaccine delay and refusal

The first objective of this study was to investigate individual, interpersonal, and community factors that influence HPV

vaccine decisions. At the individual level, knowledge, perception of the vaccine, trust in a healthy immune system, and motherhood influenced HPV vaccine decisions. At the interpersonal level, quality provider communication, mother's influence, and family and cultural norms played a role in vaccination status. At the community level, access to quality care and negative health care encounters also influenced health care utilization and HPV vaccine delay and refusal. Themes were consistent regardless of nativity status. However, themes that were more prominent for Mexican-born participants included lack of access, lower HPV knowledge, and fewer communication opportunities about HPV; the first two reflect findings from another national study (Bhattacharya et al., 2021).

### Importance of individual, interpersonal, and community factors

The second objective of this study was to uncover how participants ascribe meaning to these messages. Most participants described their vaccine status as amenable with further information, research, and understanding of HPV and the vaccine. Previous studies found greater HPV knowledge to be associated with HPV vaccine uptake and completion among adult women (Daley et al., 2010; Wilson et al., 2016). Past studies have shown young Latinas to have lower levels of HPV knowledge (Gerend & Shepherd, 2011; Hopfer et al., 2017). Despite all participants in this study being offered the HPV vaccine by their medical providers in young adulthood, several participants still attributed their low HPV knowledge and lack of understanding of the vaccine to their decision to remain unvaccinated. Motherhood is an individual factor that may positively influence HPV perceptions and intention. Mothers in this study felt messages regarding the urgency to understand a vaccine that could help them live longer and be there for loved ones may more likely resonate with MA women. Health care interventions and messaging targeting young adult MA mothers should urge vaccination to ensure they protect their health to take care of their children.

Negative HPV vaccine messages cast doubt on the perceived importance of the HPV vaccine and safety. Participants encountered negative messages at the interpersonal level from family and had few opportunities to discuss HPV with providers. These messages led to distrust or skepticism of the vaccine. The influence of relational (including negative) messages from family has been found in two college student studies across races and ethnicities (Hopfer & Clipard, 2011; Krieger et al., 2011).

Community-level factors attributed to HPV vaccine delay and refusal included cost, access barriers including health insurance coverage for the vaccine, and clinic visit experiences. Participants described these barriers as a hassle to resolve and low priority among competing personal



obligations. Similar multilevel, structural access barriers have been described by Hispanic farmworker populations in Florida (Vamos et al., 2021).

### **Influence of individual, interpersonal, and community factors**

Last, this study sought to understand how these messages affected intentions to vaccinate. Given the lack of prior knowledge about HPV vaccine, one provider recommendation may not always be sufficient to increase vaccine uptake; participants wanted more opportunities to discuss pros and cons with a provider. Participants attributed their delay to their own omission (e.g., lack of attention or initiative to vaccinate), lack of communication by provider or parent, and accessibility issues. Disparity in awareness of the preventive benefits of HPV vaccination and relevant health information persists among MA women (Gelman et al., 2011). Consistent with findings from a national population-based study (Bhattacharya et al., 2021), Mexican-born participants more often attributed their unvaccinated status to their lack of knowledge and low accessibility of health care resources.

Many Mexican-born women expressed independence regarding their health and that their parents had traditional views that conflicted with their beliefs. English-speaking Mexican-born Latinas may feel they understand and can navigate the health care system easier than their parents. Mother–daughter communication about HPV may be an important avenue for receiving HPV vaccine information, and Mexican-born women may be at a greater disadvantage. In a North Carolina-based study, approximately 90% of mothers of vaccinated daughters aged 10–20 reported discussing the HPV vaccine with their daughters before vaccination (McRee et al., 2011). Although mother–daughter communication about HPV can be positive or negative (Hopfer et al., 2019; McRee et al., 2011), noncommunication regarding the HPV vaccine may result in missed opportunities to learn more about the vaccine. Future studies should explore mother–daughter communication by nativity status and whether it explains lower HPV vaccination rates in Mexican-born Latinas compared with U.S.-born Mexican Latinas. Mexican-born participants stated their preference to avoid mother–daughter communication related to HPV vaccination and sexual reproductive issues. Past work has found provider recommendations to predict HPV vaccine uptake (Gerend et al., 2016; Rosenthal et al., 2011). Quality provider communication is an important aspect in increasing HPV vaccine uptake and completion (Oh et al., 2021; Shay et al., 2018).

Cultural and family norms were also identified as interpersonal reasons women avoided the HPV vaccine. Many participants, regardless of nativity status, described HPV

as a taboo topic because it is related to a sexually transmitted virus. Thus, the HPV vaccine may not be discussed or may be seen as negative when cultural and religious beliefs promote abstinence until marriage. When family members disapprove of a decision, going against their wishes may create a rift in the family bond by disappointing parents.

As in past work exploring HPV vaccine uptake in U.S. young adults (Zimet et al., 2010), MA women, especially those without insurance, were concerned about vaccine costs and insurance coverage. Even among women with insurance, medical coverage was not consistent, creating access barriers. Medical staff members did not deliver necessary information in a way that clearly communicated the rationale and urgency of HPV vaccination. Rare and brief encounters with medical professionals coupled with overly cumbersome paperwork deterred interest in inquiring more about the HPV vaccine. Mexican-born women may have additional challenges navigating a health care system not frequently utilized in childhood.

Increasing HPV vaccination is a pressing health concern because the coronavirus pandemic may have exacerbated undervaccination (NCI-Designated Cancer Centers, 2021; Toh et al., 2021). MA women in this study said they rarely visited health centers prior to the coronavirus outbreak and even less since the beginning of the pandemic. Clinic-based interventions should reach women outside the clinic setting (e.g., email, patient portals) to disseminate HPV vaccine information and address top concerns among MA patients.

### **Strengths and limitations**

This study focused on Mexican- and U.S.-born young MA women. Mexican-born women have higher HPV infection rates compared to U.S.-born MA women (Cokkinides et al., 2012). Knowledge from this study may be used to empirically explore and address health inequities attributed to HPV-associated cancers. Participants were sampled by nativity status to capture potential differences in themes or strength of factors influencing HPV refusal or delay. This study also sampled women already accessing health care services at FQHCs because of the high proportion of low-income Latino patients they primarily serve. Unvaccinated high-risk patients who routinely receive health care services may be more amenable to change through a clinic-based intervention. Additionally, the sampling design permitted the verification of HPV vaccine status through electronic medical records and self-report.

This study has some limitations. It explored structural aspects of access to health care; therefore, potential participants who had not lived in California for the past 3 years were excluded. Consequently, recent migrants were not

captured in this study. This study found most differences by nativity status at interpersonal and community levels of influence. It is possible studies exploring HPV vaccine delay and refusal among recent MA migrants may uncover additional factors, particularly at the individual level. However, non-U.S.-born young adult women who arrived less than 10 years ago have similar vaccination rates to those who arrived more than 10 years ago (Centers for Disease Control and Prevention, 2018). All participants in this study could speak English. Monolingual or mostly Spanish-speaking young adult women may have additional access barriers not identified in this study. Future studies should explore reasons for HPV vaccine delay and refusal among recently migrated Mexican-born MA women and monolingual Spanish-speaking young adults to explore potential differences. Additionally, participants in this sample were recruited from FQHCs. Participants in this sample may reflect characteristics of patients routinely receiving health care and have access to low-cost clinic-based services tailored to underrepresented populations. Findings may not be generalizable to MA young adult women not utilizing health care services or those in different health care environments. Although all participants were offered the HPV vaccine in adulthood, there was no restriction on when the HPV vaccine could have been offered. Older participants in this sample may have had more difficulty recalling details of their experience.

## Conclusion

This qualitative investigation of HPV vaccine delay and refusal using the NIMHD research framework advanced the understanding of how individual, interpersonal, and community factors influence HPV vaccine delay and refusal. NET helped to elicit authentic experiences of the HPV vaccine decision-making process. Mexican- and U.S.-born MA women shared similar vaccine delay and refusal narratives, except Mexican-born women stated they spoke with fewer family members about health decisions, including HPV vaccination, and had less experience navigating the health care setting. Future studies should empirically test factors identified in this study to investigate which factors may affect Mexican-born women to a higher degree than U.S.-born MA women and better explain differences in HPV vaccination uptake and completion rates.

Findings can also be used to improve health messages and provider communication among young MA women. Research that disaggregates subgroups is an important step in addressing health disparities of underrepresented groups in the U.S. (Srinivasan et al., 2015). Study findings highlight that MA women have several reasons to decline or delay the HPV vaccine, multiplying hesitancy and altering their perception of accessibility. Future studies should

simultaneously explore factors that influence HPV vaccine delay and refusal at multiple levels to uncover factors that explain a higher degree of variance in HPV vaccine uptake.

Findings from this study build on past work by detailing the perspectives of MA women, particularly unvaccinated women, their health information needs, and the failure of the medical system and practitioners to communicate the importance and urgency of prioritizing HPV vaccination among MA women. MA women may benefit from clinic-based technology efforts that alleviate accessibility issues and increase knowledge of services. Resonant HPV vaccine messaging for MA women may benefit from normalizing vaccination and emphasizing how vaccination can protect life longevity to be there for MA women's families.

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## Declarations

**Conflict of interest** The authors have no conflicts of interests or competing interests to disclose.

**Consent to participate** Participants were provided information sheets and gave research staff verbal consent to participate in the research study.

**Ethical approval** IRB approval for study protocol was received by the University of California Irvine.

**Human and Animal Rights** All procedures followed were in accordance with ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000.

**Informed Consent** Informed consent was obtained from all patients for being included in the study.

## References

- Alvidrez, J., Castille, D., Laude-Sharp, M., Rosario, A., & Tabor, D. (2019). The National Institute on Minority Health and Health Disparities research framework. *American Journal of Public Health, 109*, S16–S20. <https://doi.org/10.2105/AJPH.2018.304883>
- Bhattacharya, M., Xiong, S., & McRee, A. (2021). Nativity differences in awareness and knowledge about HPV infection and vaccination among US adults: Findings from a natinoal population-based sample. *Journal of Immigrant and Minority Health, 1007/s10903-021-01268-7*
- Centers for Disease Control and Prevention. (2018). *Vaccination coverage among adults in the United States, National Health Interview Survey, 2016*. <https://www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/pubs-resources/NHIS-2016.html#data-source-methods>
- Clandinin, D. J. (2006). Narrative inquiry: A methodology for studying lived experience. *Research Studies in Music Education, 27*, 44–54. <https://doi.org/10.1177/1321103X060270010301>
- Cokkinides, V. E., Bandi, P., Siegel, R. L., & Jemal, A. (2012). Cancer-related risk factors and preventive measures in US Hispanics/Latinos. *CA: A Cancer Journal for Clinicians, 62*, 353–363. <https://doi.org/10.3322/caac.21155>
- Conduent Healthy Communities Institute. (2021). *Cervical cancer incidence rate*. <http://www.ochealthiertogether.org/indicators/index/view?indicatorId=181&localeId=267>
- Daley, E. M., Vamos, C. A., Buhi, E. R., Kolar, S. K., McDermott, R. J., Hernandez, N., & Fuhrmann, H. J. (2010). Influences on human papillomavirus vaccination status among female college students. *Journal of Women's Health, 19*, 1885–1891. <https://doi.org/10.1089/jwh.2009.1861>
- Flores, A. (2017). *How the U.S. Hispanic population is changing*. <https://www.pewresearch.org/fact-tank/2017/09/18/how-the-u-s-hispanic-population-is-changing/>
- Gelman, A., Nikolauski, C., Schwarz, E. B., & Borrero, S. (2011). Racial disparities in awareness of the human papillomavirus. *Journal of Women's Health, 20*, 1165–1173. <https://doi.org/10.1089/jwh.2010.2617>
- Gerend, M. A., & Shepherd, J. E. (2011). Correlates of HPV knowledge in the era of HPV vaccination: A study of unvaccinated young adult women. *Women and Health, 51*, 25–40. <https://doi.org/10.1080/03630242.2011.540744>
- Gerend, M. A., Shepherd, M. A., Lustria, M. L. A., & Shepherd, J. E. (2016). Predictors of provider recommendation for HPV vaccine among young adult men and women: Findings from a cross-sectional survey. *Sexually Transmitted Infections, 92*, 104–107. <https://doi.org/10.1136/sextrans-2015-052088>
- Hopfer, S. (2012). Effects of a narrative HPV vaccination intervention aimed at reaching college women: A randomized controlled trial. *Prevention Science, 13*, 173–182. <https://doi.org/10.1007/s1121-011-0254-1>
- Hopfer, S., & Clippard, J. R. (2011). College women's HPV vaccine decision narratives. *Qualitative Health Research, 21*, 262–277. <https://doi.org/10.1177/1049732310383868>
- Hopfer, S., Duong, H. T., & Garcia, S. (2019). Mother-daughter communication about HPV vaccination. In A. Alford & M. Miller-Day (Eds.), *Constructing motherhood and daughterhood across the lifespan* (pp. 147–163). Peter Lang.
- Hopfer, S., Garcia, S., Duong, H. T., Russo, J. A., & Tanjasiri, S. P. (2017). A narrative engagement framework to understand HPV vaccination among Latina and Vietnamese women in a Planned Parenthood setting. *Health Education and Behavior, 44*, 738–747. <https://doi.org/10.1177/1090198117728761>
- Jemal, A., Simard, E. P., Dorell, C., Noone, A.-M., Markowitz, L. E., Kohler, B., Ehemann, C., Saraiya, M., Bandi, P., Saslow, D., Cronin, K. A., Watson, M., Schiffman, M., Henley, S. J., Schymura, M. J., Anderson, R. N., Yankey, D., & Edwards, B. K. (2013). Annual report to the nation on the status of cancer, 1975–2009, featuring the burden and trends in human papillomavirus (HPV)-associated cancers and HPV vaccination coverage levels. *Journal of the National Cancer Institute, 105*, 175–201. <https://doi.org/10.1093/jnci/djs491>
- Krieger, J. L., Kam, J. A., Katz, M. L., & Roberto, A. J. (2011). Does mother know best? An actor-partner model of college-age women's human papillomavirus vaccination behavior? *Human Communication Research, 37*, 107–124. <https://doi.org/10.1111/j.1468-2958.2010.01395.x>
- McRee, A.-L., Reiter, P. L., Gottlieb, S. L., & Brewer, N. T. (2011). Mother–daughter communication about HPV vaccine. *Journal of Adolescent Health, 48*, 314–317. <https://doi.org/10.1016/j.jadohealth.2010.07.006>
- Miller-Day, M. (2008). Translational performances: Toward relevant, engaging, and empowering social science. *Forum: Qualitative Social Research, 9*, 54. <http://www.qualitative-research.net/index.php/fqs/article/view/402/872>
- Miller-Day, M., & Hecht, M. L. (2013). Narrative means to preventative ends: A narrative engagement framework for designing prevention interventions. *Health Communication, 28*, 657–670. <https://doi.org/10.1080/10410236.2012.762861>
- Moran, M. B., Frank, L. B., Zhao, N., Gonzalez, C., Thainiyom, P., Murphy, S. T., & Ball-Rokeach, S. J. (2016). An argument for ecological research and intervention in health communication. *Journal of Health Communication, 21*(2), 135–138. <https://doi.org/10.1080/10810730.2015.1128021>
- NCI-designated cancer centers call for urgent action to get HPV vaccination back on track. (2021). [https://www.stjude.org/content/dam/en\\_US/shared/www/media/hospital/get-hpv-back-on-track.pdf](https://www.stjude.org/content/dam/en_US/shared/www/media/hospital/get-hpv-back-on-track.pdf)
- Oh, N. L., Biddell, C. B., Rhodes, B. E., & Brewer, N. T. (2021). Provider communication and HPV vaccine uptake: A meta-analysis and systematic review. *Preventive Medicine, 148*, 106554. <https://doi.org/10.1016/j.ypmed.2021.106554>
- Onwuegbuzie, A. J., & Leech, N. L. (2007). A call for qualitative power analyses. *Quality and Quantity, 41*, 105–121. <https://doi.org/10.1007/s11135-005-1098-1>
- Pérez, A. E., Agénor, M., Gamarel, K. E., & Operario, D. (2018). Nativity disparities in human papillomavirus vaccination among US adults. *American Journal of Preventive Medicine, 54*, 248–258. <https://doi.org/10.1016/j.amepre.2017.10.019>
- Peterson, C. E., Silva, A., Holt, H. K., Balanean, A., Goban, A., & Dykens, A. (2020). Barriers and facilitators to HPV vaccine uptake among US rural populations: A scoping review. *Cancer Causes and Control, 31*, 801–814. <https://doi.org/10.1007/s10552-020-01323-y>
- Rosenthal, S., Weiss, T. W., Zimet, G. D., Ma, L., Good, M., & Vichnin, M. (2011). Predictors of HPV vaccine uptake among women aged 19–26: Importance of a physician's recommendation. *Vaccine, 29*, 890–895. <https://doi.org/10.1016/j.vaccine.2009.12.063>
- Saraiya, M., Unger, E. R., Thompson, T. D., Lynch, C. F., Hernandez, B. Y., Lyu, C. W., Steinau, M., Watson, M., Wilkinson, E. J., Hopenhayn, C., Copeland, G., Cozen, W., Peters, E. S., Huang, Y., Sibug Saber, M., Altekruse, S., Goodman, M. T., HPV Typing of Cancers Workgroup. (2015). US assessment of HPV types in cancers: Implications for current and 9-valent HPV vaccines. *Journal of the National Cancer Institute, 107*, djv086. <https://doi.org/10.1093/jnci/djv086>
- Shay, L. A., Baldwin, A. S., Betts, A. C., Marks, E. G., Higashi, R. T., Street, R. L., Persaud, D., & Tiro, J. A. (2018). Parent-provider communication of HPV vaccine hesitancy. *Pediatrics, 141*, e20172312. <https://doi.org/10.1542/peds.2017-2312>

- Siegel, R. L., Fedewa, S. A., Miller, K. D., Goding-Sauer, A., Pinheiro, P. S., Martinez-Tyson, D., & Jemal, A. (2015). Cancer statistics for hispanics/latinos, 2015. *CA: A Cancer Journal for Clinicians*, 65, 457–480.
- Srinivasan, S., Moser, R. P., Willis, G., Riley, W., Alexander, M., Berigan, D., & Kobrin, S. (2015). Small is essential: Importance of subpopulation research in cancer control. *American Journal of Public Health*, 105, s371–s373. <https://doi.org/10.2105/AJPH.2014.302267>
- Toh, Z. Q., Russell, F. M., Garland, S. M., Mulholland, E. K., Patton, G., & Licciardi, P. V. (2021). Human papillomavirus vaccination after COVID-19. *JNCI Cancer Spectrum*, 5, pkab011. <https://doi.org/10.1093/jncics/pkab011>
- Tracy, S. J. (2019a). Advanced data analysis: The art and magic of interpretation. In S. J. Tracy (Ed.), *Qualitative research methods: Collecting evidence, crafting analysis, communicating impact* (pp. 236–264). John Wiley and Sons.
- Tracy, S. J. (2019b). Data analysis basics: A phronetic iterative approach. *Qualitative research methods: Collecting evidence, crafting analysis, communicating impact* (pp. 208–235). John Wiley and Sons.
- U.S. Census Bureau. (2019). *U.S. Census Bureau QuickFacts: United States*. <https://www.census.gov/quickfacts/fact/table/CA,US/PST045219>
- Vamos, C. A., Vazquez-Otero, C., Kline, N., Lockhart, E. A., Wells, K. J., Proctor, S., Meade, C. D., & Daley, E. M. (2021). Multi-level determinants to HPV vaccination among Hispanic farmworker families in Florida. *Ethnicity and Health*, 26, 319–336. <https://doi.org/10.1080/13557858.2018.1514454>
- Viens, L. J., Henley, S. J., Watson, M., Markowitz, L. E., Thomas, C. C., Thompson, T. D., Razzaghi, H., & Saraiya, M. (2016). Human papillomavirus-associated cancers—United States, 2008–2012. *Morbidity and Mortality Weekly Report*, 65, 661–666.
- Wilson, A. R., Hashibe, M., Bodson, J., Gren, L. H., Taylor, B. A., Greenwood, J., Jackson, B. R., She, R., Egger, M. J., & Kepka, D. (2016). Factors related to HPV vaccine uptake and 3-dose completion among women in a low vaccination region of the USA: An observational study. *BMC Women's Health*. <https://doi.org/10.1186/s12905-016-0323-5>
- Zimet, G. D., Weiss, T. W., Rosenthal, S. L., Good, M. B., & Vichnin, M. D. (2010). Reasons for non-vaccination against HPV and future vaccination intentions among 19–26 year-old women. *BMC Women's Health*. <https://doi.org/10.1186/1472-6874-10-27>

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