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HPV-related knowledge, attitudes, practices, and the impact of the COVID-19 pandemic on vaccine practices among Eastern U.S. Hispanic communities.

By

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# HPV-related knowledge, attitudes, practices, and the impact of the COVID-19 pandemic on vaccine practices among Eastern U.S. Hispanic communities.

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Emory Rollins School of Public Health
2023

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**Abstract**

HPV-related knowledge, attitudes, practices, and the impact of the COVID-19 pandemic on vaccine practices among Eastern U.S. Hispanic communities.

By: Andrea Torres

Introduction:

In 2021, human papillomavirus (HPV) vaccine initiation in US Hispanic adults over 18 years of age is 48.8% for women and 24.7% for men. Hispanic communities struggle with culture specific barriers to vaccination, such as religion, traditional gender roles, and parental attitudes. There is a lack of data regarding Hispanic men and women's HPV vaccination attitudes, knowledge, and practices, creating a lack of accurate vaccine messaging.

Methods:

Using an online panel survey of 472 Hispanic adults in 25 states east of the Mississippi River between January-February 2023, we assessed self-reported HPV-and COVID-19 related knowledge, attitudes, practices, and predictors of behaviors. Findings were assessed using counts and proportions, with multivariable log-binomial regression used to assess predictors of HPV vaccine uptake.

Results:

HPV vaccination was highest among 18-to-25-year old's (22.5%) with differences in age (19.9% uptake for 26–32-year old's and 10.8% uptake for 33–40-year old's). Females (31.4%), urban residents (26.3%), and second-generation Americans (24.8%) were more likely to be vaccinated. Participants were more likely to be vaccinated against HPV when there was family history of HPV related cancers (cervical cancer (PR 1.39, 95% CI 1.18,1.63), oropharyngeal cancer (PR 1.52, 95% CI 1.29, 1.78). For COVID-19, those with a South American ethnic background were more likely to vaccinate than any other ethnic type (PR 1.28, 95 CI% 1.14, 1.42). The highest COVID-19 vaccine uptake occurred among 18–25-year old's (30% compared to 26% of 26-32-year old's and 18% of 33-4- year old's).

Discussion:

This study may offer directions to move forward for understanding determinants of HPV vaccination among Hispanic populations, to support future outreach and intervention efforts. COVID-19-vaccine uptake showed similar differences across demographics as with HPV vaccine uptake, indicating there may be some potential for combined education or combined campaigns based on the similar mindset towards vaccines deduced from this study.

# HPV-related knowledge, attitudes, practices, and the impact of the COVID-19 pandemic on vaccine practices among Eastern U.S. Hispanic communities.

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Table of Contents

1. Introduction

Human papillomavirus (HPV) is a common epithelial virus that causes six types of cancer (cervical, vaginal, vulvar, anal, penile, and oropharyngeal). The estimated prevalence of HPV infections was estimated at 43 million individuals in the US, with nearly 13 million Americans contracting new HPV infections annually (CDC, 2021); the Centers for Disease Control and Prevention (CDC) state that most Americans will be exposed over their lifetime.

HPV is spread through intimate skin to skin contact as well as all forms of sexual activity. Every year, 47,199 new cases of cervical, vaginal, vulvar, anal, penile, and oropharyngeal cancer arise, with 37,300 of those cases linked to HPV infection (CDC, 2022). To prevent HPV infection and subsequent HPV-related diseases, HPV vaccine is administered for those aged 9-14 years old, though routine catch-up vaccination is usually recommended through age 26. HPV vaccination of 27–45-year-olds is based on a shared clinical decision recommendation. The vaccine protects against infection from the 9 HPV types responsible for 90% of cervical cancers and genital warts (CDC, 2022).

As of 2021, series completion rates of HPV vaccine among 13-17-year-olds was 61.7%, with a slight differential by sex (63.8% females and 59.8% males (Pingali, 2021). HPV vaccine coverage among adults is even lower. In 2018, 42% of non-Hispanic, white, adults were vaccinated with one or more doses of HPV vaccine compared to 36.1% of Hispanic adults. Non-Hispanic white women had a vaccination initiation rate of 57.9% compared to 48.8% of Hispanic women (NCHS, 2018). In 2020, HPV vaccine uptake was still lower among Hispanic adults, where 48.8% of adult women aged 18-26 years old had initiated vaccination and 24.7% of adult men aged 18-26 years old had initiated vaccination (NCHS,2020).

Hispanic peoples are defined as those from "the Americas and Spain who speak Spanish or are descended from Spanish speaking communities" (Campos, 2021, UCA). The difference in vaccination coverage between adult men and women in with different ethnic backgrounds among Hispanic communities proves the need studies with specific attention to Hispanic cultural norms and practices – and specifically, for those studies to be conducted by Hispanic investigators.

New data on knowledge, attitude, and practices (KAP) are needed to address current vaccine campaigns and education for HPV vaccine uptake among different Hispanic communities (Shelton, 2013). The current limited literature suggests that Hispanic men are less likely than Hispanic women to initiate or complete the HPV vaccine series due to lack of knowledge; Hispanic males view HPV as a woman's infection (Fernandez, 2018). However, uptake may have changed post COVID-19; in one study, higher religiosity was associated with COVID-19 vaccine hesitancy and rejection among Puerto Ricans (López-Cepero, 2022).

The current study conducted evaluates how these knowledge, attitude, and practices (KAP) have changed after the COVID-19 vaccine was authorized, and after the bulk of the pandemic occurred. We utilized a cross-sectional survey to assess current KAP among Hispanic participants with different ethnic subgroupings, and assessed different predictors for acceptance or rejection of HPV vaccine.

2. Literature review

The study revolves around knowledge, attitudes, and practices (KAP) of HPV vaccinations post COVID-19 among Hispanic populations in the U.S. The study focuses on the Hispanic population in 25 states east of the Mississippi to reach various ethnic backgrounds among adult Hispanics. The working topic will assess how the COVID-19 pandemic has changed the Hispanic community's mindset on vaccinations against other preventable diseases, specifically, HPV. HPV vaccination aids in preventing HPV infections and subsequent HPV related cancers in both women and men. The surrounding HPV vaccines knowledge and education among Hispanic women and men will be assessed during this cross-sectional survey. The existing literature describes existing data related to HPV KAP and Covid-19 among Hispanic communities but fails to address current KAP of HPV post Covid-19.

*HPV vaccine knowledge*

In a study published by Warner et al, the group assesses the demographic factors associated with the HPV vaccine knowledge and awareness in a developing Hispanic community in Salt Lake City, Utah. The study was conducted among parents of 11- to 17-year-olds. After 2 months of conducting a survey among the target population, they concluded that survey participants had a higher awareness of the HPV vaccine, but a lower knowledge on the HPV vaccine and infection itself. The most important finding was that there was limited knowledge of the HPV vaccine availability to both girls and boys. The study also states that awareness and knowledge on the HPV vaccine was significantly associated with education and country of origin. Due to this relationship between awareness and ethnic type, we assessed specific sexual education, ethnic background, generation-American identity, and language preference, our study to understand the current knowledge on HPV vaccines.

Ojinnaka et al conducted a study in 2017 which assesses the determinants of HPV vaccine awareness and practice among females. They had assessed females of three different ethnic backgrounds such as non-Hispanic whites, non-Hispanic blacks, and Hispanic women. The study was conducted to explore factors of HPV vaccine awareness and discussion among low-income women involved in a cancer prevention program in Texas (grant funded program) as well as healthcare provider discussions of the HPV vaccine among female residents in the U.S. There is a reference to two separate studies conducted, one among African American women and another among Latina mothers. Both studies referenced concluded a low HPV vaccine awareness (19% of African American participants knew about the vaccine while 78% of Hispanic mothers had not heard of the vaccine). In the referenced study among Hispanic mothers, 80% of participants showed interest in the HPV vaccine for their daughters (no mention of sons) after learning about the benefits. There are also existing gender inequalities as men are less likely to know about the HPV vaccine compared to women (no mention of specific ethnicities). Similarly, Calderon-Mora et al (2020) released a study that examines the HPV attitudes and practice among Hispanic women and their vaccine-age eligible children. The study population consisted of 21–65-year-old women living in Texas. The study population consisted of 599 women, 98% of which identified as Hispanic and 86% of the Hispanic women were Spanish speakers. Participants expressed having a son or daughter younger than 26 years old. 91% of participants did not have a primary care provider and only about 13% of the study population had gotten the HPV vaccine. Although a low HPV vaccine uptake was reported in parents, 51% (n=179) of Hispanic mothers reported having vaccinated their daughters and 42% (n=74) had vaccinated their sons against HPV infections. There is a difference in gender that needs to be explored.

The study also found that Hispanic mothers with children expressed intent to vaccinate; 83.4% would vaccinate their daughters and 92% would vaccinate their sons. Once the knowledge assessment was completed, it was determined that most people did not know that most HPV infections clear on their own or that HPV does not cause obvious symptoms. The most common barriers for lack of child vaccination were cost, accessibility, and lack of information. A study conducted by Chido-Amajuoyi et al (2021) further assessed the current state of mind in the U.S. population on HPV risk and HPV vaccination and knowledge. Their study uses data from the Health Information National Trends Survey data and concluded that overall, there was a 5% decline of HPV and HPV vaccine awareness since 2008. There was a difference between racial minorities, rural residents, male population, and those with lower education compared to their counterparts (non-Hispanic White, urban residents, female population, and higher education). The data suggests that a 10% decline occurred among males and that non-Hispanic whites had a higher HPV and HPV vaccine awareness, since 2013.

The study by Chido-Amajuoyi et al highlights disparities between gender, social and racial/ethnic background, and access to non-English public health communications. The study also emphasizes an existing gap in current literature between government funded HPV vaccination programs and education and increased HPV related awareness assessments. Our cross-sectional study analyzes demographic information of our Hispanic study population to address relationships between these variables and vaccination outcomes to assess current vaccine campaign gaps.

*HPV vaccine coverage*

A study conducted by Boakye and their study team assessed the KAP of HPV among U.S. adults. They specified their study to target and observe racial and gender inequalities in the

U.S. The importance of this study was highlighting the current practices of HPV vaccination since due to the cancer-causing subtypes (most cervical cancer cases, 95% of anal cancer cases, 73% of oropharyngeal cancer cases, 65% of vaginal cancer cases, 50% of vulvar cancer cases, and 35% of penile cancer cases). The study highlights how the HPV vaccine and education occurred among females first followed by male education 5 years later. In 2017, vaccination for HPV was about 28% among males, which the study by Boakye might not include different ethnic backgrounds in their count. The study sees a relationship between knowledge about the disease, intervention, and incentive to receive intervention (HPV vaccine). Minorities would need most of the attention during targeting campaigns for this preventive method, as the communication and awareness remained low in 2017. A study by Henry et al in 2018 emphasizes the need for higher education and information communication among all boys in the U.S. on HPV vaccination. HPV vaccine initiation is low for males of all races and ethnicities. The importance of this study is that it illustrates the low HPV vaccine uptake dating back to 2012-2013, which remains suboptimal among males in 2022. The study provides information on the inequality of HPV vaccine uptake between different residential areas and socioeconomic factors. Although high poverty areas offer more vaccine coverage (and free vaccine coverage) and urban areas resulted in higher vaccine uptake, non-urban and low poverty areas should also have importance.

Cooper et al (2018) conducted a study among 18–27-year-old males attending a university in southeastern United States to assess HPV knowledge, vaccination status, sexual behaviors, and intent to vaccinate. The study was beneficial in understanding the relationship between prior knowledge and intent to vaccinate when discussing sexual behaviors among different racial and ethnic backgrounds. The study included about 67% of participants identified as Hispanic or non-Hispanic Black. The results illustrate the need for emphasis of HPV and

adverse HPV-related outcomes to increase vaccine uptake among these population of males. Males in the study had previous sexual experience (73%) and some are currently sexually active (50%) with most sexually active participants identifying as Hispanic or non-Hispanic Black with a much earlier sexual experience compared to other races. Eighty percent of participants knew about HPV but only 56% knew about an HPV vaccine. Seventy-one percent of the participants did not express intention of vaccinating against HPV infections. Of those few participants that had prior HPV vaccine knowledge (28%) were more likely to get the HPV vaccine than those without prior knowledge (15%). This information is useful post-COVID-19, due to vaccine hesitancy and misinformation from the mRNA vaccines. The misinformation surrounding vaccinations and vaccine mandates between anti-vax groups and public health agencies has drastically impacted the public's perception on vaccination (Buttorff et al, 2022) decreasing the intent to vaccinate. The glimpse given from this study is alarming due to the resistance of vaccination against HPV infections and a low risk prospective among males.

This NCHS data brief from January 2020 includes vaccination data and practices for the HPV vaccine from 2013-2018. A key finding in this briefing is that in 2018, non-Hispanic White adults were more likely than Hispanic adults to have ever received at least one does of the HPV vaccine. The Hispanic population has a disproportionate HPV vaccine rate among males and females with females having a higher HPV vaccine initiation than males (49% vs 25%). Although the rate of HPV vaccination overall has increased from 22% to 40%, there is a difference among female and male vaccination uptake and initiation. Females were more likely to vaccinate at or before 12 years old as opposed to vaccination at 15 to 17 years old.

*HPV attitudes among Hispanic communities*

A study conducted in Florida aimed to assess the challenges among migrant farm workers with HPV vaccination. Vamos et al (2021) conducted focus groups in Spanish for parents of 9–15-year old's. The three focus groups were made of rural, faith-based Hispanics that belonged to a community organization in their area. The study assessed different attitudes among the focus groups such as past experiences with the healthcare system, which could be negative or positive. They also assessed the concerns over HPV vaccine access, series completion, need, and costs. They expressed a need for a more catered vaccine campaign for this population such as taking their financial and situational experiences with HPV vaccination access and healthcare access. The study concluded that a community tailored and culturally appropriate multi-level vaccine program and education is needed for this group. The study conducted by Morales-Campos et al (2018) emphasizes the importance of Hispanic fathers' role in HPV vaccination among Hispanic teens. The study group used focus groups to discuss the gendered perspectives of HPV vaccination and KAP from Hispanic mothers and fathers, resulting in highly gendered findings. Both focus group's female participants had misconceptions surrounding HPV infection and contraction.

Another major barrier among the Hispanic community includes Hispanic culture, which involves religion and familial relationships. The study from Frietze et al (2020) focuses on the difference in personal duty regarding family dynamic. Hispanic individuals tend to come from a tight-knit family with multigenerational households or communities. Hispanics in the U.S. have been found to be more in favor or group solidarity, meaning that if perceived benefit is high for a vaccine, intent to vaccinate was higher. The sense of obedience and social responsibility leads to a higher vaccine uptake compared to Hispanics that were raised in an individualistic society. Data published in 2003, although outdated, suggests most Hispanics identify as Roman catholic.

The relationship with religion may or may not affect vaccine acceptability in a household as data from a 2013 study indicates that catholic-identified families were more likely to vaccinate than non-affiliated or born-again religions. Our study assesses the religiosity and vaccination status of our Hispanic population.

Women believed that it was due to inanimate object contact (public restrooms or showers) as well as adultery and promiscuous behavior. Hispanic men were more likely to blame female promiscuity. Hispanic males also attributed their lack of vaccine intent due to the belief that vaccination leads to increased sexual behavior. HPV vaccination education and beliefs in this focus group led to Hispanic males and females think that HPV vaccines protect Hispanic females who are promiscuous. Our study assesses the current knowledge status among Hispanics by quizzing the population on contraction, risk, and cancer caused by HPV. Frietze et al (2020) emphasizing the gap between male and female HPV vaccination is attributed to the "feminization of the HPV vaccine". In 2017, HPV vaccination rates in males was lower than females, with an increase in genital wart and cancer incidence among males. The existing National Immunization Survey-Teen assessed the barrier for male vaccination, which concluded that male respondents claimed that they lacked HPV recommendations from health care providers. This is important to note as Hispanic men are more likely to experience HPV-related cancer and morbidity in comparison to Caucasian men, especially penile cancer related to HPV infection. Our study analyzes the amount of Hispanic male participants that believe cervical cancer as the highest risk from oncogenic HPV infection.

Not only is there a need to tailor to specific rural immigrant communities, but there is also a need to tailor infographics of pap smears for women and HPV vaccines. A study by Spencer et al in 2019 addresses the disparities and reverse disparities in HPV vaccinations in the

U.S. The study assesses the difference among racial groups and genders. Non-Hispanic black and Hispanic women have a higher cervical cancer incidence compared to non-Hispanic white women in the U.S. A major cause in this difference of incidence is the lower use of screening methods by minority women, where the annual checkups (every 3 years) were much lower for Hispanic women than non-Hispanic whites. The study addresses the perspective where women falsely believe they received a screening when they have not, leading to a difference between these ethnic groups. Although HPV vaccines have been proven to be an effective intervention, the study states that only 43% of all 13–17-year old's have completed the HPV vaccine series. There have been major differences among vaccine uptake studies among minorities, where some studies state racial and ethnic disparities vs other studies stating a favorable number for minorities. After completing the analysis, the study concludes that there was a stronger HPV vaccine initiation among minority groups (non-Hispanic blacks and Hispanics) compared to non-Hispanic whites. However, despite higher initiation among minority groups, this group was less likely to complete vaccination series than non-Hispanic whites.

Kellogg et al (2019) conducted a study to assess the HPV immunization status of Latino/Hispanic adolescents in the U.S. The data was extracted from a survey administered in Los Angeles County college students to students who were 18 years and older. Thirty four percent of college students were Hispanic/Latino in 2015. About 65% of males and 51.6% of females were not aware that the HPV vaccine was recommended through 26 years of age. Alarmingly, 47.6% were not aware that their college student health center offered the HPV vaccine. The study highlights the risks of HPV infection and those populations at risk more than others; Women have the highest prevalence of HPV infection. The study also shed light on attitudes shared among this cohort; 75% of college students did not think they were at risk for

HPV infection. There was a common lack of knowledge on transmission with most students unaware that HPV infections can be contracted with just skin-to-skin contact, condoms do not protect 100% against infection, and that HPV can lead to cancer related outcomes (20% of minority students). Twenty seven percent of participants were not immunized and 23% were unsure if they received the HPV vaccine or not. 86% of participants were sexually active and 24 of the participants had been treated for previous STI's.

Cooper et al (2017) created this study to assess the HPV vaccine attitude and knowledge among different male ethnic groups. According to this study, non-Hispanic Black and Hispanic men suffer HPV-related cancers at later stages than any other racial/ethnic group. The study assessed HPV vaccination knowledge and cancer awareness. Hispanic men have higher rates of HPV-related penile cancers compared to non-Hispanic males. This study emphasizes the need for more HPV vaccination recommendations from providers to these populations. Men who are part of ethnic and racial minority groups do not trust information from physicians and are less likely to initiate HPV vaccination. Our cross-sectional study assesses the relationship between HPV-induced cancer types and HPV vaccination uptake. Due to the likelihood of family history, we hypothesized the positive uptake of HPV vaccines as a preventive measure.

*COVID-19*

A study was conducted by Piper et al (2022) to understand the beliefs of certain Hispanic groups regarding COVID-19 and COVID-19 vaccination resistance. The study provides useful insight on political, media sources, and cultural influences that shape the opinions and practices among 225 adult Hispanics surveyed. The survey assessed the unvaccinated participants opinions on controversial COVID-19 anecdotes such as the vaccine causing infertility in women. The study population consisted of 51.6% Hispanic adult females. Participants were asked to identify

ethnic background with 48%, 20%, and 6% of the participants identified as Mexican, Puerto Rican, and Cuban. When asked about reasons for non-vaccination, most adult Hispanic participants stated concern for side effects and safety while only a small percentage claimed religious beliefs did not allow vaccination. Most participants agreed that the vaccine was "rushed" and didn't feel it was conducted the right way. The second most popular opinion was the belief that the vaccine didn't work. The lack of vaccination due to cost was an alarming discovery since the vaccine was free; this could mean that there is a misconception about vaccination access among some Hispanic populations.

Kricorian (2021) This study assessed the vaccination beliefs among U.S. Black and Hispanic populations, which were more affected by COVID-19 among other diseases. The study population assessed Black, Hispanic, and White populations in the United States with 1,950 participants. Vaccine hesitancy was higher among Black and Hispanic populations than among the White population. Participants from Black and Hispanic populations in the U.S. stated that they would feel more comfortable accepting a vaccine offer from a same-race medical professional as well as a vaccine that was studied among same-race and ethnicity populations. It is important to note that this would build a higher rapport between health care professionals, public health agencies, and these historically marginalized populations. Our study analyzes the trust levels between Hispanic participants and HPV vaccine and Covid-19 vaccine uptake.

Momplaisir (2021) conducted a vaccine hesitancy survey before authorization of the COVID-19 vaccine with most hesitance coming from Black and Hispanic healthcare workers. The study was conducted among healthcare workers of different racial/ethnic backgrounds in two large hospitals in the United States. This served to assess the COVID-19 vaccine hesitancy among those with some healthcare background and knowledge. The study resulted in high

vaccine hesitancy among Black healthcare workers and Hispanic or Latino healthcare workers. The study participants included 10,866 participants that reported race and ethnic identities. Most participants were White with only 307 or 2.8% of participants identified as Hispanic or Latino. Vaccine hesitancy was higher among Black and Hispanic healthcare workers when compared to White healthcare workers. Our study assesses the Covid-19 vaccine status among Hispanics which can give us the insight that this study misses, as our population is only Hispanic.

*Conclusion*

There is an existing gap of HPV vaccinations among Hispanic men and Hispanic women as well as lack of information on post-COVID-19 vaccination attitudes towards HPV. The current cross-sectional study conducted by the research group aims to find associations between vaccine uptake against HPV and predictors to bridge the knowledge gap post-Covid-19. The current literature has either focused on one ethnic type (usually Mexican or Mexican American), one gender type (most studies conducted among women), and one specific region. To assess the current KAP, our study assesses different Hispanic communities with a variety of ethnic backgrounds. This will be more representative of current Hispanic populations and attitudes of 2023.

3. Results/Manuscript

**Title:** HPV-related knowledge, attitudes, practices, and the impact of the COVID-19 pandemic on vaccine practices among Eastern U.S. Hispanic communities.

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**Contributors:**

AT, RB, KH contributed to data collection; AT, RB contributed to analysis/interpretation; AT, KH, RD drafted the article; All authors critically revised the article; All authors provided approval of the submitted version.

## Declaration of interests

Authors declare no competing interests.

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The views expressed are those of the authors alone and do not necessarily reflect the policies or recommendations of the institutions with whom they are affiliated.

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**Abstract**

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Using an online panel survey of 472 Hispanic adults in 25 states east of the Mississippi River between January-February 2023, we assessed self-reported HPV-and COVID-19 related knowledge, attitudes, practices, and predictors of behaviors. Findings were assessed using counts and proportions, with multivariable log-binomial regression used to assess predictors of HPV vaccine uptake.

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HPV vaccination was highest among 18-to-25-year old's (22.5%) with differences in age (19.9% uptake for 26–32-year old's and 10.8% uptake for 33–40-year old's). Females (31.4%), urban residents (26.3%), and second-generation Americans (24.8%) were more likely to be vaccinated. Participants were more likely to be vaccinated against HPV when there was family history of HPV related cancers (cervical cancer (PR 1.39, 95% CI 1.18,1.63), oropharyngeal cancer (PR 1.52, 95% CI 1.29, 1.78). For COVID-19, those with South American ethnic background were more likely to vaccinate than any other ethnic type (PR 1.28, 95 CI% 1.14, 1.42). The highest COVID-19 vaccine uptake occurred among 18–25-year old's (30% compared to 26% of 26-32-year old's and 18% of 33-4- year old's).

Discussion:

This study may offer directions to move forward for understanding determinants of HPV vaccination among Hispanic populations, to support future outreach and intervention efforts. COVID-19-vaccine uptake showed similar differences across demographics as with HPV vaccine uptake, indicating there may be some potential for combined education or combined campaigns based on the similar mindset towards vaccines deduced from this study.

1. Introduction

In 2021, the United States (US) Centers for Diseases Control and Prevention (CDC) estimated the prevalence of Human Papillomavirus (HPV) infections at 43 million individuals infected in the US, with nearly 13 million Americans contracting new HPV infections annually (CDC, 2021). To prevent HPV infection and subsequent HPV-related diseases, HPV vaccine is administered for those aged 9-14 years old, though routine catch-up vaccination is usually recommended through age 26.

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The difference in vaccination coverage between adult men and women in with different ethnic backgrounds among Hispanic communities proves the need studies with specific attention to Hispanic cultural norms and practices – and specifically, for those studies to be conducted by Hispanic investigators. New data on knowledge, attitude, and practices (KAP) are needed to address current vaccine campaigns and education for HPV vaccine uptake among different Hispanic communities (Shelton, 2013). The current limited literature suggests that Hispanic men are less likely than Hispanic women to initiate or complete the HPV vaccine series due to lack of knowledge; Hispanic males view HPV as a woman's infection (Fernandez, 2018). However, uptake may have changed post COVID-19; in one study, higher religiosity was associated with

COVID-19 vaccine hesitancy and rejection among Puerto Ricans (López-Cepero, 2022). The current study conducted evaluates how these knowledge, attitude, and practices (KAP) have changed after the COVID-19 vaccine was authorized, and after the bulk of the pandemic occurred.

Methods

We conducted a cross-sectional survey of Hispanic communities in the eastern United States regarding HPV and COVID-19 KAP. The survey was administered through Qualtrics, LLC (Provo, UT), which handled all participant recruitment, enrollment, and data management, through their existing survey panels. Two versions of the survey, in both English and Spanish, were available to participants, and survey language presentation was based on participant preference indicated at the start of data collection. After consenting to participate and completing the screening questions, and getting through the screening questions, and getting through the screening questions the survey took an average of 6 minutes to complete. IRB determined this study to be exempt human studies research, and data collection occurred during January 2023. Towards the end of the 4-week survey timeline, we received a total of 472 participants and responses. Data were downloaded from the Qualtrics servers to a limited access, HIPAA-compliant research server, for which only study team members had access. The data was imported into SAS 9.4 (Cary, NC) for data management and analysis (Emory University, Atlanta, GA).

The survey focused on HPV KAP post-Covid-19. Knowledge-related questions included identifying which cancers were HPV-related, which age groups can receive the HPV vaccine, and which gender identities can contract HPV. Attitude questions included questions about trust level among our population with certain providers or government agencies, vaccination

importance, and vaccination willingness. Practice-based questions included vaccination status for HPV and COVID-19 and series completion. Further survey questions included knowledge of HPV vaccine access, completion of HPV vaccine series, perceptions of vaccines in general post Covid-19, and sex education in an educational setting or religious setting. We also analyzed personal and familial history of certain HPV-related cancers.

*Study population*

Inclusion criteria included participants that identify as Hispanic (as defined by those from "the Americas and Spain who speak Spanish or are descended from Spanish speaking communities" (Campos, 2021, UCA)); between the ages of 18 and 40; able to provide informed consent, and residing in one of the following states: Alabama, Georgia, Florida, South Carolina, North Carolina, Tennessee, Kentucky, Virginia, Illinois, Indiana, Ohio, West Virginia, Wisconsin, Minnesota, Pennsylvania, Maryland, Delaware, New York, New Jersey, Connecticut, Rhode Island, Massachusetts, New Hampshire, Vermont, and Maine. These 25 eastern states were chosen to reflect a variety of ethnic Hispanic backgrounds (Caribbean, Mexican, central American and south American). Exclusion criteria included individuals who do not meet Qualtrics quality control measures (survey completion time out of typical range, straight line responses where respondents select all response options in the same location, indicating a lack of attentive response), and those who do not speak English or Spanish.

Ethnicity in this study is categorized as Hispanic; in this survey, Hispanic ethnicity includes the following countries: Mexico, El Salvador, Honduras, Guatemala, Nicaragua, Panama, Ecuador, Peru, Chile, Argentina, Colombia, Venezuela, Cuba, Puerto Rico, Dominican Republic, Costa Rica

*Data management*

After downloading from Qualtrics servers, data was imported into a secure computer system and into SAS and excel to begin data cleaning and analysis. The "Attitudes" questionnaire portion of our study included a Likert scale from not important (scale 1-20) to highly important (scale 81-100) rating the importance of HPV vaccination, HPV vaccine implementation in school aged children, and benefits of HPV vaccination. The attitudes on vaccinations post COVID-19 were analyzed as well. The survey portion of "Knowledge and practices" included responses that were multi-level outcomes and were recoded as binary variables for a simpler analysis. After creating multiple new binary variables for each new response, data analysis was conducted to assess correct and incorrect knowledge responses.

*Study analysis*

Counts and proportions (for categorical data) and measures of central tendency were computed for all variables. Key outcomes, as described above, were stratified by socio-demographic characteristics. We analyzed the relationship between HPV vaccination uptake and key independent demographic variables using a predictive model to assess the relative contribution of all included factors. Regression analysis was conducted using log-binomial regression. The same model was used for predictive association between family history of cervical, oropharyngeal, penile, and anal cancers and our outcome of HPV vaccination. An adjusted multivariate analysis was conducted for language preference, generation type, ethnicity, age, gender, and residency. Counts and proportions were used to analyze the knowledge assessment of the Hispanic community in our study to illustrate the current baseline knowledge on HPV vaccines. The same binomial framework was used to assess independent demographic variables and Covid-19 vaccine uptake.

Results

*Demographic and practices*

The final study sample consisted of responses from 472 participants; most were female (N = 250, 53%), with a plurality of residents aged 18-25 years (N = 194, 41%) Participants were mostly of urban residency (N=220, 47%), mostly second-generation born Americans (N=169, 42.4%), and mostly of Caribbean Hispanic or mixed Caribbean Hispanic descent (N=228, 48%). Most participants in the study chose English as their preferred language with only 11.4% (N=54) choosing the Spanish version of the survey (Table 1). The overall HPV vaccine initiation for our study population was 53. 2% (N=251). Covid-19 vaccine uptake in our sample was higher, with most of the study population initiating vaccination with N=346, or 73.3%. HPV vaccination uptake was highest among those18-to-25-years old (42.3%). A small difference was seen by age group, with 19.9% of 26-32-year old's vaccinated and 10.8% among those 33–40-year-old. Women (31.4%), urban residents (26.3%), and second-generation Americans (24.8%) yielded the highest HPV vaccine uptake. Religious affiliation illustrated an even split of HPV vaccine uptake among Catholic Hispanics with 17% of Catholic Hispanic participants stating they were not vaccinated against HPV and 17% of Catholic Hispanic participants stating they did receive the HPV vaccine (Table 2). Neither language preference nor generation type shows a relationship to HPV vaccine uptake. Age groups were also found to have no statistically significant relationship to vaccination uptake nor have a difference in demographic predictors.

The study population's familial history for HPV-related cancers (figure 1, figure 2), illustrate that vaccination history was higher for individuals with family history of HPV-related cancers. Of the 71.4% of individuals with any reported family history, 26.3% indicated history of cervical cancer, 17.4% of oropharyngeal cancer, 14.0% of anal cancer, and 13.8% of penile cancer. We illustrate the breakdown of familial cancer history among our study population (figure 2). We

also stratified the distribution of personal HPV-related cancer history of study participants and four of the HPV-related cancer types: cervical, oropharyngeal, anal, and penile cancers (figure 3). A participant was more likely to be vaccinated against HPV when there is family history for cervical cancer with a prevalence ratio of 1.39, (95% Confidence interval of 1.18,1.63), oropharyngeal cancer (PR 1.52, 95% CI 1.29, 1.78), penile cancer (PR 1.35, 95% CI 1.13, 1.61), and anal cancer (PR 1.34, 95% CI 1.12, 1.60).

While the unadjusted comparison found no difference in vaccination between the 18–25-year-old group and the 33-40-year-old age group, in the fully adjusted predictive model, younger adults aged 18-25 were 17% more likely to be vaccinated than the 33-40-year old age group (95% CI 1.03, 1.32). For the Covid-19 analysis, South American ethnic background was 28% more likely to vaccinate than any other ethnic type (PR 1.28, 95 CI% 1.14, 1.42) (table 3). The highest Covid-19 vaccine uptake occurred among 18–25-year old's (30% compared to 26% of 26-32-year old's and 18% of 33-4- year old's)

Other variables positively associated with vaccine uptake were Catholic religiosity (aPR 0.78 95% CI 0.63, 0.96) and non-religious identity (aPR 0.69 95% CI 0.49, 0.97) when adjusting for all demographic variables in the model. We assessed HPV vaccination status with an outcome of an abnormal pap screen and saw an association between vaccination status and abnormal pap screening ( aPR 1.71; 95% CI 1.05, 2.79).

*Knowledge*

Most participants (56.36%) correctly identified that cervical cancer was a cancer caused by HPV infection. While respondents could choose all potential cancers associated with HPV infection, only 8 (1.7%) selected all appropriate HPV-related cancers (cervical, anal, oropharyngeal, vaginal, penile, and vulval). Several participants incorrectly included lung cancer

(17.2%), prostate cancer (27.5%), and breast cancer (20.3%) as cancer types caused by HPV. Most (70%) participants chose cisgender women as most at risk, though 150 (31.8%) correctly chose all genders (cis women, cis men, trans women, trans men, non-binary/non-conforming) as individuals at risk for HPV infection. Thirty five percent of participants (N=166) chose ages 11 and 12 as primary recipients of the vaccine while another 33.9% (160) chose 13-to-17-year-old age group. When asked about youngest age group to initiate vaccination, 23.7% of participants (N=112) chose 13-17 as the youngest age group that can receive the HPV vaccine with 23.1% (N=109) choosing the 11–12-year-old group. 70.3% of participants (n=332) knew where to get the HPV vaccine.

*Attitudes:*

46.4% of participants identified as having a child or children of any age (n=338) but not initiating HPV vaccination (n=219). The response most chosen was that they deemed the HPV vaccine as unsafe, with 39.6% of parental participants choosing this (n=67), followed by 26.6% (n=45) choosing lack of importance as the reasoning. Other options included religious reasoning (8.3%), goes against free will (15.4%), and viewed it as more harmful than helpful (10.1%). Forty one percent of participants stated that their opinions about routine vaccination changed positively post COVID-19, agreeing that vaccines should be distributed more in schools and communities (n=195). When asked if the media changed their perception towards infectious diseases, 44.9% stated that their opinion had changed, and there was an increase in concern of overall infectious disease dynamics (n=212).Fifty percent of participants stated that they believe more strongly in mandating vaccinations when asked if COVID-19 changed their view on vaccine mandates (n=234). We saw a different outcome of opinion when asking participants their

feelings on COVID-19, with 49.6% of participants stating it is less serious present day than when it started in 2020 (n=234).

When asked how important HPV vaccination is for the general population, 49.4% of respondents chose highly important, with an additional 38.4% ranking a potential HPV vaccine mandate among school aged children as highly important. Similar results were observed when asking participants on whether the HPV vaccine is beneficial for the population with 47.9% of respondents stating it was highly important. A moderate amount of HPV vaccine uptake occurred among those that trust their PCP (34.53%), the CDC (29.03%), and the department of public health (32.84%). The results indicate further use of these PCP, CDC, and DPH infographics and communications to continue establishment of rapport among the Hispanic communities for HPV vaccination. The study data propositions new ways to tackle future public health infographics, education, and campaigning towards the Hispanic community.

## Discussion

### *Knowledge*

Participants were asked if they knew where to get the HPV vaccine; in addition, parents were asked the HPV vaccination status of their child. The intention was to assess the barriers in place among Hispanic parents and their understanding of the HPV vaccine. Our data may be used to tailor vaccine campaigns or improve PCP communication to parents among the Hispanic community. Most Hispanic parents stated that they did not trust the vaccine and think it's more harmful than beneficial, which contrasts the consensus of our parental and non-parental Hispanic study population's acceptance of HPV vaccines. This contrast – and the fear of harmful side effects - of the HPV vaccine can improve PCP and patient communication, and aid in decision making efforts among pediatricians and parents. Most study participants (70.3%) knew where to receive

the HPV vaccine but only half of them (53.2%) had received the vaccine. The responses for lack of HPV vaccination included individuals claiming it was not important and parental refusal for vaccination. Further discussion using other methods such as focus groups or educational meetings among the community can decipher the reasoning and further educate. This is a stark contrast to a study conducted by Ojinnaka et al. In 2017; this study assessed the determinants of HPV vaccine awareness and practice among females. That study found that among Hispanic mothers, 80% of participants showed interest in the HPV vaccine for their daughters (no mention of sons) after learning about the benefits. The referenced study also studies existing gender inequalities as men are less likely to know about the HPV vaccine compared to women (no mention of specific ethnicities). Language preference could attribute to difference in participation of vaccine programs, infographics, and education, as many outreach efforts are in English. However, most participants in our study chose English as their preferred language. It may be that the study results are more applied to those Hispanics that are comfortable with the English language, especially as they had to navigate an English website to get to the survey, which may not reflect the knowledge of dominant Spanish speaking Hispanics.

*Attitudes*

We assessed participants response of receiving sexual education in both an educational setting as well as a religious setting. Seventy four percent of participants stated to have received sex education in an educational setting and 23.16% stated they have received sex education in a religious setting, illustrating a potential relationship between religion and sexual education which can affect HPV vaccination uptake among this population (n=321). The religiosity aspect and sex taboo among religions (Catholicism, Judaism, Christianity, etc.), and those who are devout in their faith, could be addressed with appropriate sex education reform from religious educators.

Targeting interventions among religious communities may be a sensitive topic due to the taboo, appropriate measures should be planned out to ensure positive reception. A recommendation can include educating and training community health minsters or other religiously involved leaders to facilitate sensitive and appropriate information among Hispanic communities that identity with an organized religion.

We also analyzed the impact of Covid-19 on participants opinions on HPV vaccination policies and benefits. Covid-19 vaccination initiation was higher among our population than HPV vaccine uptake. The COVID-19 vaccine was released for emergency use in 2021, using mRNA technology; this new vaccination technology is often the source of fear. The HPV vaccine was released in 2008 and has multiple vaccine efficacy studies, some of which span years. The difference in vaccine uptake between the two viruses prompts for further research among the Hispanic community as to why one vaccine was an easier choice to make. A similar study conducted by Warner et al. in 2016 assessed the demographic factors associated with the HPV vaccine knowledge and awareness in a developing Hispanic community in Salt Lake City, Utah, finding that awareness and knowledge on the HPV vaccine was significantly associated with education and country of origin. In the study, the study population comprised of mostly second-generation Americans (42.4%), which leads to a hypothesis regarding a difference in awareness due to a longer residency in the United States as compared to first generation Americans. Targeting first generation or immigrant communities through vaccine education and campaign may increase HPV vaccine uptake within these communities.

The results illustrated mixed-results on post-COVID-19 attitude changes towards trust in public media, providers, and vaccines. Our study participants also gave insight on current trust levels with public health agencies, and government agencies. The results from the study indicate

a higher level of trust among Hispanics towards PCP's and state department of health. The trust levels are lower regarding the CDC, the government in general, social media, news outlets, and celebrities (table 4). Trust levels then vary among vaccine types, with the group most vaccinating against HPV showing high trust in their PCP's, CDC, and DPH (table 6). This phenomenon was also seen among those vaccinated for Covid-19 - trust was highest among PCP's, CDC, and DPH (table 5). The understanding among the community to trust PCP's and local departments of health could help reform future HPV vaccine education and provide new strategies for campaigning among the Hispanic community, ensuring information is relayed through the highest trusted sources among the community.

*Practices*

We noted that most participants with some familial history of one or 4 of the HPV-related cancers (cervical, oropharyngeal, anal, penile) had been vaccinated against HPV. The association between vaccination and family history may infer that knowing an inherent risk is present, preventive measures are taken (vaccination). Perhaps seeing a loved on suffer over a diagnosis such as cancer could also inspire individuals to protect themselves and their children with vaccination initiation - and completion. Sexual activity could also influence the need to protect against HPV infection, which was not analyzed in this study. Cooper et al (2018) conducted a study among 18–27-year-old males attending a university in southeastern United States to assess HPV knowledge, vaccination status, sexual behaviors, and intent to vaccinate. The study was beneficial in understanding the relationship between prior knowledge and intent to vaccinate when discussing sexual behaviors among different racial and ethnic backgrounds. Males in the referenced study had previous sexual experience (73%) with most currently sexually active participants identifying as Hispanic or non-Hispanic Black. Of those few participants that had prior

HPV vaccine knowledge (28%) were more likely to get the HPV vaccine than those without prior knowledge (15%). The relationship between our study and the current literature can aid in assessing sexual influence on vaccination compared to familial history influence on vaccination against HPV. These results illustrate the need for emphasis of HPV and adverse HPV-related outcomes to increase vaccine uptake among these population of males.

Limitations

This analysis may have been impacted by respondents predominantly choosing English for the survey. To truly assess the impact that Spanish speaking and Spanish language education as a predictor for HPV vaccine uptake and knowledge, a fully Spanish language survey and study should be conducted in the future, as only 54 of the 472 participants were predominantly Spanish speakers. In our study, a quarter of the participants were from one state (FL); a larger study with more equitable distribution across states should be contemplated for future studies. The study focused on four HPV-related cancer types, which will not represent the full scope of HPV-related cancer history for participants and their families. Further studies are needed to assess the relationship of vaginal and vulval cancers and HPV vaccine uptake and KAP among Hispanics. The study did not address HPV vaccination and wart prevention, which could lead to further vaccine campaigning and education in this community.

The study also assessed the eastern United States, representing specific ethnic groups found more in the Eastern states. This was chosen due to the key differences in ethnic diversity between eastern and western states. Most Mexican descendants reside in the western US, which can lead to an underrepresented study for the entire Hispanic population. Using a specific geographic location will also include populations with similar access, education, and personal experiences which gives insight on the HPV vaccine attitudes and practices. Although this study was among a convenience

sample of eastern U.S. Hispanic populations, mostly from Florida, previous research has found that convenience samples are generally qualitatively similar to larger probability-based samples (Coppock, 2018).The regional choice may also influence the language preference of mostly English-speaking Hispanics. The study gathered limited data on parental attitudes about the HPV vaccine and child vaccination as well as reasons to avoid HPV vaccine initiation. Although not the goal of our study, further studies, post-COVID-19, is needed to further assess parental attitudes on the HPV vaccine program. The limited data provided gave a small insight that should not be used to completely assess current parental attitudes on the HPV vaccine.

Conclusions

The KAP findings from this study can support future campaign efforts for HPV vaccination among Hispanic populations. The data illustrates that not only are participants inclined to vaccinate due to family history of HPV-related cancer types but are also more likely to vaccinate when identifying as non-denominational. The limitations of this study that have been identified can help shape future research studies among Hispanic populations, addressing questions in ways our study did not. The results of this study could result in more targeted vaccine campaigning among first generation Americans, immigrant communities, a variety of ethnic backgrounds, and religious identities.

4. Conclusions and Public Health Implications

This study resulted in current post-COVID-19 knowledge, attitudes, and practices on HPV vaccine among the Hispanic community in eastern U.S. states. The KAP from our study can align future campaign efforts for HPV vaccination to Hispanic populations. The data illustrates that not only are participants inclined to vaccinate due to family history of HPV-related cancer types but are also more likely to vaccinate when identifying as non-denominational. The results of identifying as Catholic and vaccinating against HPV resulted in a split decision to vaccinate and refuse vaccination; when asking Hispanic parents about child vaccination, 39.7% chose that they deemed the HPV vaccine as unsafe, which can be addressed by further educating Hispanic parents during pediatric appointments about safety. Participants also stated that HPV was linked to breast, lung, and prostate cancer with most participants correctly knowing that cervical cancer is linked to HPV. The results prompt for a reform on HPV vaccination information and communication among the Hispanic community to better understand adverse HPV infection outcomes.

With study participants stating their attitudes on HPV vaccines post COVID-19, a positive consensus among the Hispanic study population concluded the importance and benefits of HPV vaccinations and vaccines in general. This information could be used to reform future vaccination programs and education for future vaccine introductions or campaigns. Study participants that chose to reject HPV vaccination did not trust government officials (31.99%) post-COVID-19. This can be addressed by mending the relationship between government agencies in general and Hispanic communities, establishing trust over time. This study could offer education on the protective and beneficial estimates and outcomes of vaccination and adverse HPV-related outcomes.

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6. Tables

Table 1.Demographic Information (N=472)

| Characteristic | Value | N | % | T |
|---|---|---|---|---|
| | | | | |
| AGE | | | | |
| | 18-25 years old | 194 | 41.10% | |
| | 26-32 years old | 157 | 33.30% | |
| | 33-40 years old | 121 | 25.60% | 100.00% |
| GENDER | | | | |
| | Female | 250 | 52.97% | |
| | Male | 181 | 38.35% | |
| | Other [a] | 41 | 8.69% | 100.01% |
| | | | | |
| RELIGION | | | | |
| | Catholic | 160 | 33.90% | |
| | Other Christian/Organized religion [b] | 125 | 26.49% | |
| | Nothing in particular | 113 | 23.94% | |
| | Other/Not listed | 74 | 15.68% | 100.01% |
| | | | | |
| RESIDENCY | | | | |
| | Urban | 220 | 47.00% | |
| | Suburban | 203 | 43.40% | |
| | Rural | 45 | 9.60% | 100.00% |
| | | | | |
| GENERATION BORN IN THE U.S. | | | | |
| | First | 141 | 35.30% | |
| | Second | 169 | 42.40% | |
| | Third | 89 | 22.30% | 100.00% |
| ETHNIC TYPE [c] | | | | |
| | Caribbean/ Mixed | 228 | 48.31% | |
| | Mexican/ mixed Mexican | 157 | 33.26% | |
| | Central American/Mixed | 54 | 11.44% | |
| | South American/ Mixed | 45 | 9.53% | 102.54% |
| | | | | |
| LANGUAGE PREFERENCE | | | | |
| | English | 418 | 88.60% | |
| | Spanish | 54 | 11.40% | 100.00% |

a= defined as transgender women, transgender men, non-binary, or non-conforming
b= defined as including protestant, Mormon, Greek, Jewish, Jehovah's witness, seventh day Adventist, Muslim, Buddhist, Hindu, atheist, and agnostic.
c= may not equal 100% as some participants identified as two ethnic background types, resulting in double counting for some persons, equaling more than 100%.

Table 2. HPV vaccination uptake by demographic type

| Predictor variable | | Vaccinated against HPV | | Not vaccinated against HPV | | Bivariate analysis PR (95%) | Multivariate analysis aPR (95%)[c] |
|---|---|---|---|---|---|---|---|
| | | N | % | N | % | | |
| Overall (n=472) | | | | | | | |
| AGE (N=472) | | | | | | | |
| | 18-25 years old | 106 | 54.6% | 88 | 45.4% | 0.91 (0.82, 1.01) | 1.16 (0.91, 1.48) |
| | 26-32 years old | 94 | 59.9% | 63 | 40.1% | 0.83 (0.67, 1.02) | 1.16 (1.03, 1.32) |
| | 33-40 years old | 51 | 42.2% | 70 | 57.9% | ref | ref |
| | | | | | | | |
| GENDER (N=472) | | | | | | | |
| | Other [a] | 24 | 58.5% | 17 | 41.5% | ref | ref |
| | Male | 79 | 43.7% | 102 | 56.4% | 1.15 (1.00. 1.33) | 0.75 (0.52, 1.07) |
| | Female | 148 | 59.2% | 102 | 40.8% | 1.33 (0.99, 1.77) | 1.10 (0.79, 1.52) |
| | | | | | | | |
| RELIGION | | | | | | | |
| | Catholic | 80 | 50.0% | 80 | 50.0% | 0.91 (0.76, 1.10) | 0.78 (0.63, 0.96) |
| N=125 | Other Christian/organized religion [b] | 76 | 60.8% | 49 | 39.2% | ref | ref |
| | Nothing in particular | 66 | 58.4% | 47 | 41.6% | 1.13 (0.94, 1.36) | 0.91 (0.72, 1.14) |
| | Other/Not listed | 29 | 39.2% | 45 | 60.8% | 0.70 (0.52, 0.95) | 0.69 (0.49, 0.97) |
| | | | | | | | |
| RESIDENCY (N=472) | | | | | | | |
| | Urban | 123 | 55.9% | 97 | 44.1% | 0.86 (0.75, 0.98) | 1.52 (0.98, 2.38) |
| | Suburban | 110 | 54.2% | 93 | 45.8% | 0.74 (0.57, 0.97) | 1.42 (0.91, 2.22) |
| | Rural | 14 | 31.1% | 31 | 68.9% | ref | ref |
| | | | | | | | |
| GENERATION (N=472) | | | | | | | |
| | First | 79 | 56.0% | 62 | 44.0% | 0.95 (0.85, 1.07) | 1.20 (0.93, 1.54) |
| | Second | 99 | 58.6% | 70 | 41.4% | 0.91 (0.72, 1.15) | 1.18 (0.92, 1.51) |
| | Third | 44 | 49.4% | 45 | 50.6% | ref | ref |
| | | | | | | | |
| ETHNIC TYPE (N=472) | | | | | | | |
| | Mexican/mixed Mexican | 92 | 58.6% | 65 | 41.4% | 1.16 (0.98, 1.38) | 1.20 (0.80, 1.80) |
| | Central American/ Mixed | 26 | 48.2% | 28 | 51.9% | 0.89 (0.67, 1.20) | 1.03 (0.62, 1.71) |
| | South American/ Mixed | 21 | 46.7% | 24 | 53.3% | 0.87 (0.63, 1.20) | 1.01 (0.61, 1.67) |
| | Caribbean/ Mixed | 120 | 52.6% | 108 | 47.4% | 0.98 (0.83, 1.16) | 1.17 (1.76, 1.80) |
| | | | | | | | |
| LANGUAGE PREFERENCE (N=472) | | | | | | | |
| | English | 228 | 54.6% | 190 | 45.4% | 0.78 (0.57, 1.08) | 0.91 (0.644, 1.28) |
| | Spanish | 23 | 42.6% | 31 | 57.4% | ref | ref |

a= defined as transgender women, transgender men, non-binary, or non-conforming

b= defined as including protestant, Mormon, Greek, Jewish, Jehovah's witness, seventh day Adventist, Muslim, Buddhist, Hindu, atheist, and agnostic.

c=adjusted multivariate run, for all variables in the demographic portion

Table 3. HPV vaccination uptake by demographic type

| Predictor variable | | Vaccinated against COVID-19 | | Not vaccinated against COVID-19 | | Bivariate analysis PR (95%) | Multivariate analysis aPR (95%) [c] |
|---|---|---|---|---|---|---|---|
| | | N | % | N | % | | |
| AGE (N=472) | | | | | | | |
| | 18-25 years old | 140 | 72.2% | 54 | 27.8% | 0.99 (0.93, 1.06) | 1.01 (0.87, 1.17) |
| | 26-32 years old | 121 | 77.1% | 36 | 22.9% | 0.99 (0.87, 1.13) | 0.98 (0.90, 1.06) |
| | 33-40 years old | 85 | 70.3% | 36 | 29.8% | ref | ref |
| | | | | | | | |
| GENDER (N=472) | | | | | | | |
| | Other [a] | 27 | 65.9% | 14 | 34.2% | ref | ref |
| | Male | 136 | 75.1% | 45 | 24.9% | 1.02 (0.94, 1.11) | 1.06 (0.85, 1.34) |
| | Female | 183 | 73.2% | 67 | 26.8% | 1.04 (0.88, 1.22) | 1.02 (0.82, 1.29) |
| | | | | | | | |
| RELIGION | | | | | | | |
| | Catholic | 123 | 76.9% | 37 | 23.1% | 1.08 (0.96, 1.20) | 1.00 (0.86, 1.16) |
| N=125 | Other Christian/organized religion [b] | 93 | 74.4% | 32 | 25.6% | ref | ref |
| | Nothing in particular | 82 | 72.6% | 31 | 27.4% | 0.99 (0.87, 1.12) | 1.07 (0.90, 1.27) |
| | Other/Not listed | 48 | 64.9% | 26 | 35.1% | 0.87 (0.73, 1.03) | 0.83 (0.63, 1.10) |
| | | | | | | | |
| RESIDENCY (N=472) | | | | | | | |
| | Urban | 163 | 74.1% | 57 | 25.9% | 0.96 (0.88, 1.04) | 1.13 (0.87, 1.46) |
| | Suburban | 151 | 74.4% | 52 | 25.6% | 0.91 (0.77, 1.08) | 1.15 (0.88, 1.48) |
| | Rural | 28 | 62.2% | 17 | 37.8% | ref | ref |
| | | | | | | | |
| GENERATION (N=472) | | | | | | | |
| | First | 107 | 75.9% | 34 | 24.1% | 0.96 (0.89, 1.03) | 1.11 (0.94, 1.30) |
| | Second | 131 | 77.5% | 38 | 22.5% | 0.91 (0.79, 1.06) | 1.09 (0.92, 1.29) |
| | Third | 60 | 67.4% | 29 | 32.6% | ref | ref |
| | | | | | | | |
| ETHNIC TYPE (N=472) | | | | | | | |
| | Mexican/mixed Mexican | 116 | 73.9% | 41 | 26.1% | 1.01 (0.90, 1.13) | 1.17 (0.58, 2.36) |
| | Central American/ Mixed | 39 | 72.2% | 15 | 27.8% | 0.98 (0.83, 1.17) | 1.12 (0.53, 2.34) |
| | South American/ Mixed | 41 | 91.1% | 4 | 8.9% | 1.28 (1.14, 1.42) | 1.22 (0.63, 2.37) |
| | Caribbean/ Mixed | 161 | 70.6% | 67 | 29.4% | 0.93 (0.83, 1.04) | 1.16 (0.57, 2.38) |
| | | | | | | | |
| LANGUAGE PREFERENCE (N=472) | | | | | | | |
| | English | 299 | 71.5% | 119 | 28.5% | 1.22 (1.08, 1.37) | 1.23 (1.00, 1.52) |
| | Spanish | 47 | 87.0% | 7 | 13.0% | ref | ref |

a= defined as transgender women, transgender men, non-binary, or non-conforming

b= defined as including protestant, Mormon, Greek, Jewish, Jehovah's witness, seventh day Adventist, Muslim, Buddhist, Hindu, atheist, and agnostic.

c=adjusted multivariate run, for all variables in the demographic portion

Table 4. Level of trust and HPV vaccine uptake

| | Vaccinated against HPV | | | | Not vaccinated against HPV | | | | Overall | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A lot/ High | | None/Some | | A lot/ High | | None/Some | | A lot/ High trust | | Some/ No Trust | |
| | N | % | N | % | N | % | N | % | N | % | N | % |
| PCP | 163 | 58.0% | 88 | 46.1% | 118 | 42.0% | 103 | 53.9% | 281 | 59.5% | 191 | 40.5% |
| SOCIAL MEDIA | 78 | 57.8% | 173 | 51.3% | 57 | 42.2% | 164 | 48.7% | 135 | 28.6% | 337 | 71.4% |
| GOVERNMENT | 105 | 60.0% | 146 | 49.2% | 70 | 40.0% | 151 | 50.8% | 175 | 37.1% | 297 | 62.9% |
| DPT PUBLIC HEALTH | 155 | 60.3% | 96 | 44.7% | 102 | 39.7% | 119 | 55.4% | 257 | 54.5% | 215 | 45.6% |
| CDC | 137 | 58.1% | 114 | 48.3% | 99 | 42.0% | 122 | 51.7% | 236 | 50.0% | 236 | 50.0% |
| NEWS | 84 | 63.6% | 167 | 49.1% | 48 | 36.4% | 173 | 50.9% | 132 | 28.0% | 340 | 72.0% |
| CELEBRITIES | 53 | 62.4% | 198 | 51.2% | 32 | 37.7% | 189 | 48.8% | 85 | 18.0% | 387 | 82.0% |

Table 5. Level of trust and Covid-19 vaccine uptake

| | Vaccinated against COVID-19 | | | | Not vaccinated against COVID-19 | | | | Overall | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A lot/ High | | None/Some | | A lot/ High | | None/Some | | A lot/ High trust | | Some/ No Trust | |
| | N | % | N | % | N | % | N | % | N | % | N | % |
| PCP | 227 | 80.8% | 119 | 62.3% | 54 | 19.2% | 72 | 37.7% | 281 | 59.5% | 191 | 40.5% |
| SOCIAL MEDIA | 106 | 78.5% | 240 | 71.2% | 29 | 21.5% | 97 | 28.8% | 135 | 28.6% | 337 | 71.4% |
| GOVERNMENT | 141 | 80.6% | 205 | 69.0% | 34 | 19.4% | 92 | 31.0% | 175 | 37.1% | 297 | 62.9% |
| DPT PUBLIC HEALTH | 216 | 84.1% | 130 | 60.5% | 41 | 16.0% | 85 | 39.5% | 257 | 54.5% | 215 | 45.6% |
| CDC | 199 | 84.3% | 147 | 62.3% | 37 | 15.7% | 89 | 37.7% | 236 | 50.0% | 236 | 50.0% |
| NEWS | 105 | 80.0% | 241 | 70.9% | 27 | 20.5% | 99 | 29.1% | 132 | 28.0% | 340 | 72.0% |
| CELEBRITIES | 66 | 77.7% | 280 | 72.4% | 19 | 22.4% | 107 | 27.7% | 85 | 18.0% | 387 | 82.0% |

Table 6: HPV-related cancer family history and vaccination

| | Vaccinated against HPV | | | | Not vaccinated against HPV | | | | Bivariate analysis PR (95% CI) |
|---|---|---|---|---|---|---|---|---|---|
| | Family History | | | | Family History | | | | |
| Cancer type | Yes | | No | | Yes | | No | | |
| | N | % | N | % | N | % | N | % | |
| Cervical | 102 | 40.6% | 149 | 59.4% | 54 | 24.4% | 167 | 75.6% | 1.39 (1.18, 1.63) |
| Oropharyngeal | 74 | 29.5% | 177 | 70.5% | 28 | 12.7% | 87.3 | 87.3% | 1.52 (1.29, 1.78) |
| Penile | 56 | 22.3% | 195 | 77.7% | 27 | 12.2% | 194 | 87.8% | 1.35 (1.13, 1.61) |
| Anal | 59 | 23.5% | 192 | 76.5% | 29 | 13.1% | 192 | 86.9% | 1.34 (1.12, 1.60) |

7. Figures

Figure 1. Participant family history

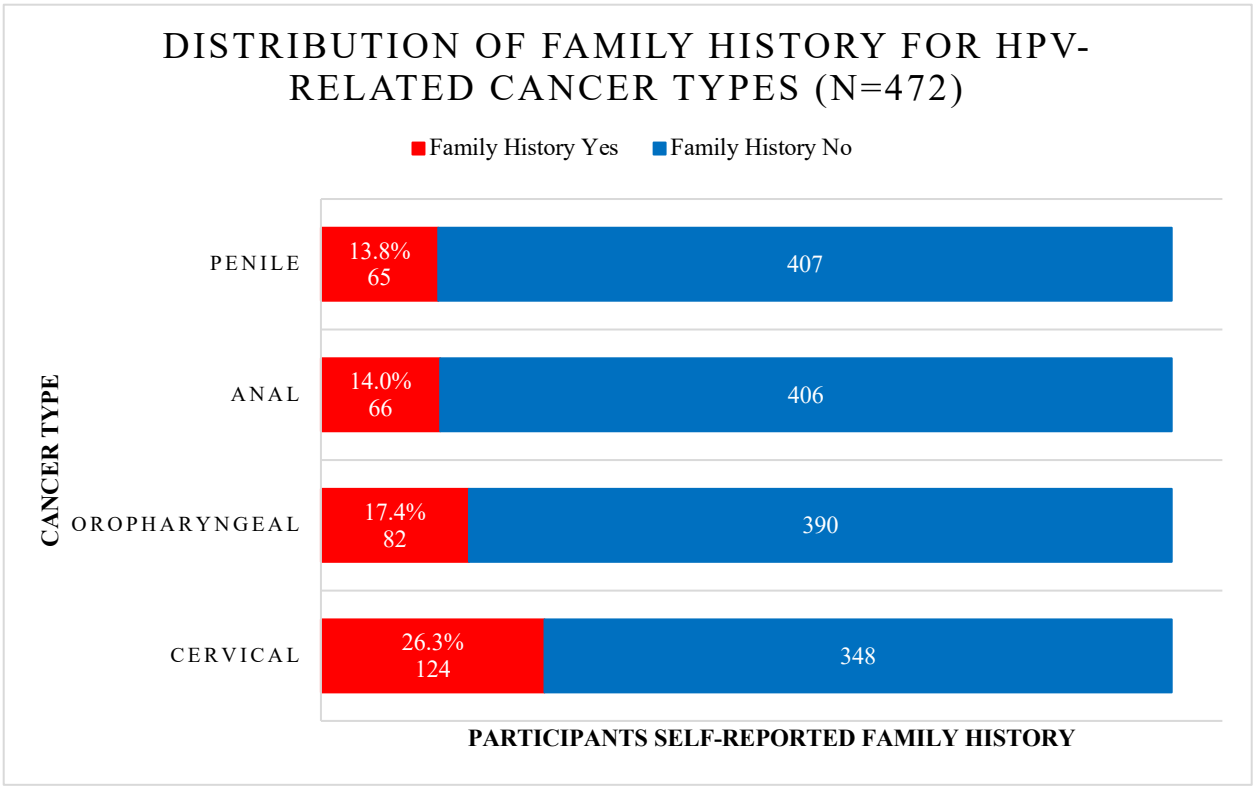

Figure 2. Participant family history

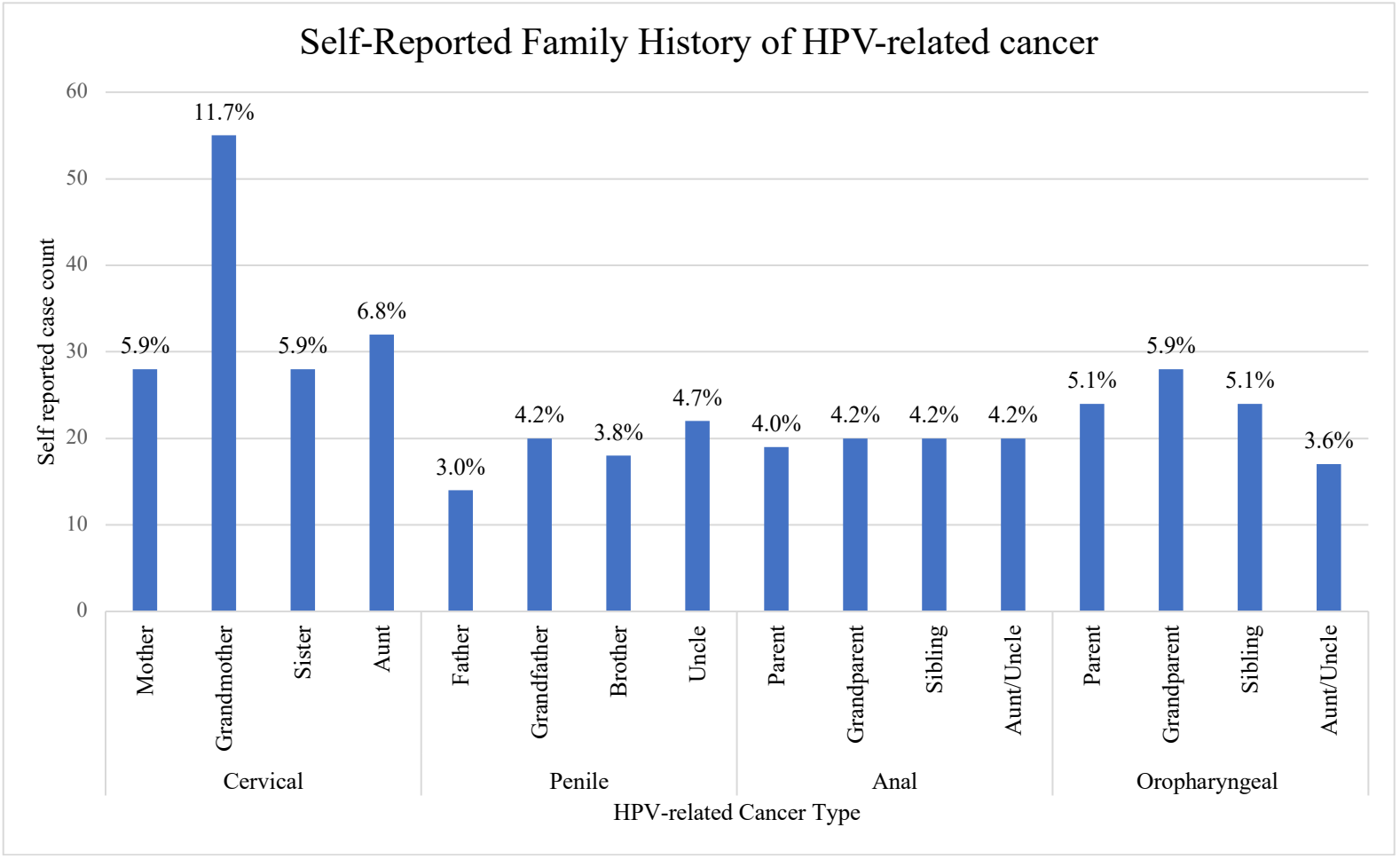

Figure 3. Participant HPV-cancer related history: self-reported