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Sociocultural Factors Associated With HPV Vaccine Uptake Among Hispanic Female Emerging Adults

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SOCIOCULTURAL FACTORS ASSOCIATED WITH HPV VACCINE UPTAKE AMONG HISPANIC FEMALE EMERGING ADULTS

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Tanjila Taskin

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To: Dean Tomás R. Guilarte
Robert Stempel College of Public Health and Social Work

This dissertation, written by Tanjila Taskin and titled Sociocultural Factors Associated with HPV Vaccine Uptake among Hispanic Female Emerging Adults, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this dissertation and recommend that it be approved.

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Florida International University, 2021

DEDICATIONS

Dedicated to my Amma (mom) Dr. Monowara Sultana, and Bappy (dad) Muhammad Sekendar Hossain, my husband, Shamsuddin Mahmud Rumi, and my sons, Muhammad Zulqifle Tahmid and Muhammad Tashfeen Abdullah.

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ABSTRACT OF THE DISSERTATION

SOCIOCULTURAL FACTORS ASSOCIATED WITH HPV VACCINE UPTAKE AMONG HISPANIC FEMALE EMERGING ADULTS

by

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Florida International University, 2021

Miami, Florida

Professor Miguel Ángel Cano, Major Professor

Human Papillomavirus (HPV) infection is the most common sexually transmitted infection in the United States (U.S.). College students are at high risk of developing HPV-related diseases and play a key role in transmitting the infection. Fortunately, HPV-related cancers can be prevented through HPV vaccination.

A cross-sectional study was designed to collect data from convenience samples of Hispanic emerging adults from Florida International University (FIU) in Miami, Florida, and the University of Houston (UH) in Houston, Texas. Participants who were 18 - 26 years old, self-identified as Hispanic or Latino/a, able to read English, and enrolled in FIU or UH were included in the study. The study was approved by the Institutional Review Boards at FIU and UH. Three independent multiple logistic regression models were used to examine the association between focal predictors and HPV vaccine uptake.

Of the available 770 participants, 87% were from FIU and 13% were from UH. The first model examined the association between cancer fatalism and HPV vaccine uptake and the moderation effect of HPV knowledge and HPV vaccine

knowledge. The study found a significant association between higher cancer fatalism and lower HPV vaccine uptake among FIU participants (aOR: 0.97; 95% CI 0.92 – 0.99) but no significant association was found among UH participants. The study did not observe any moderating effect among FIU and UH participants. The second multiple logistic regression model assessed the association between traditional gender roles and HPV vaccine uptake and the moderating effect of acculturation. The study found a significant association between higher traditional gender roles and lower HPV vaccine uptake among FIU participants (aOR: 0.94; 95% CI 0.89 – 0.99) but did not find an association among UH participants. The moderation effect was not significant in FIU or UH. The third multiple logistic regression model examined the association between familism and HPV vaccine uptake after adjusting for the potential confounders. The study found no significant association between familism and HPV vaccine uptake among FIU or UH participants.

The findings from this study suggest an association between sociocultural factors and HPV vaccine uptake among Hispanic emerging adults, which differed by study site. Many Hispanic emerging adults remain unvaccinated in the U.S. Therefore, future interventions should be designed to provide culturally tailored HPV vaccine education to Hispanic emerging adults.

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ABBREVIATIONS AND ACRONYMS

ACA	Affordable Care Act
ACIP	Advisory Community for Immunization Practices
CDC	Center for Disease Control and Prevention
CHIP	Children's Health Insurance Program
CIN	Cervical Intraepithelial Neoplasia
DNA	Deoxyribonucleic Acid
EPSDT	Early and Periodic Screening Diagnosis and Treatment program
FDA	U.S. Food and Drug Administration
FIU	Florida International University
HPV	Human Papillomavirus
IGP	Immunization Grant Program
STI	Sexually Transmitted Infection
U.S.	United States
UH	University of Houston
UK	United Kingdom
USPSTS	U.S. Preventive Services Task Force
VFC	Vaccines for Children Program
WHO	World Health Organization

CHAPTER 1: INTRODUCTION

Human Papillomavirus (HPV) infection is the most common sexually transmitted infection (STI) in the United States (U.S.) (Satterwhite et al., 2013) with an estimated 80% of women and 90% of men being infected in their lifetime (Chesson et al., 2014). HPV is a largely asymptomatic infectious condition transmitted through vaginal intercourse, anal and oral sex, and other skin-to-skin sexual contact. According to the Centers for Disease Control and Prevention (CDC), nearly 79 million individuals are infected with HPV annually in the U.S. (Centers for Disease Control and Prevention, 2017). Around 14 million new HPV infections occur among individuals aged 15-59 years, with an estimated half of the infections occurring among 15 -24-year-olds (Markowitz et al., 2014). HPV causes various types of cancers and genital warts (Centers for Disease Control and Prevention, 2020a). Fortunately, HPV-related cancers and morbidities can be prevented through HPV vaccination (Bosch et al., 2013; Lin et al., 2017; Markowitz et al., 2014). Even though the HPV vaccine has high efficiency in preventing cancers and was recommended by the Advisory Community for Immunization Practices (ACIP), vaccine uptake still remains below 80% among U.S. female emerging adults (Lu et al., 2021). Increasing HPV vaccination can eventually help to eliminate the public health crisis associated with HPV-related cancers.

1.1. What is HPV

Human papillomavirus (HPV) is a non-enveloped, double-stranded circular deoxyribonucleic acid (DNA) virus. There are more than 100 types of HPV with high and low risks potential for infectivity (Markowitz et al., 2014). The HPV DNA genome has approximately 8,000 base pairs (Kouketsu et al., 2016) that exhibit distinct tropism for the squamous epithelium (Hübbers & Akgül, 2015). Each of the HPV viruses in the group is assigned a number and is referred to as an HPV type (e.g., HPV 18). Different HPV strains will exhibit distinct L1 proteins, which will indicate their significant infection locations (Mistry et al., 2008; Schiller et al., 2010). Both L1 and L2 capsid proteins are required for the binding and entry of the virus into target cells. Specifically, L1 will bind to certain heparan sulfate proteoglycan sequences (HSPGs) and cause a conformational change in the capsid, allowing the N-termini of L2 proteins to be exposed to external enzymes (Schiller et al., 2010). The papillomaviruses can only exist in squamous epithelial cells, a specific type of cell in the human body and mostly on the wet surface, (i.e, the vagina, including the outside of the vagina, anus, cervix, and vulva). Among men, the cells can be found in the inner foreskin and urethra of the penis. In general, it can also be found in the inner nose, mouth, throat, trachea, bronchi, and inner eyelids.

Infection with HPV generally occurs after sexual activity. In most cases, HPV infections resolve spontaneously within a few years; nevertheless, persistent HPV infections have been linked to cancer and genital warts (Buttmann-Schweiger et al., 2017; Doorbar et al., 2012). HPV 16 and HPV18 are

high-risk serotypes that can cause cancer, but HPV 6 and HPV 11 are low-risk serotypes that can cause genital warts (Braxton et al., 2018). HPV can be transmitted through genital contact and oral or anal intercourse with the infected individual directly (Valentino & Poronsky, 2016).

1.2. HPV associated morbidities

HPV infection is associated with cervical (Buttmann-Schweiger et al., 2017), anogenital (vulvar, vaginal, penile, and anal) (Brianti et al., 2017), and a subset of head and neck cancers (tongue, tonsil, and other oropharyngeal sites) (Walling et al., 2016). HPV 16 and 18 cause approximately 70% of cervical cancers; however, the vaccines have high efficacy against both strains (e.g., HPV 16 and 18) (Katanyoo et al., 2014). In 2015, a total of 43,371 cancer cases were due to HPV infection (Van Dyne et al., 2018). According to the CDC, 91% of cervical and anal cancers, 75% of vaginal cancers, 69% of vulvar cancers, and 63% of penile cancers are caused by HPV infection (Centers for Disease Control and Prevention, 2020a). Approximately, 42.5% of the genital infections among adults aged 18 to 53 years were caused by HPV between 2013 and 2014 in the U.S. (McQuillan et al., 2017).

Every year, HPV causes around 530,000 new cervical cancer cases globally (de Martel et al., 2017). Cervical cancer is the fourth most common type of cancer in the U.S. and is significantly associated with HPV infection. Although cervical cancer is preventable, 4,120 women in the U.S. died from cervical cancer caused by HPV in 2016 (Centers for Disease Control and Prevention,

2014b). Hispanics (9 per 100,000) have a higher rate of cervical cancer compared to Blacks (8 per 100,000) and non-Hispanic Whites (7 per 100,000) (Centers for Disease Control and Prevention, 2014a). Fortunately, the HPV vaccine can prevent women from developing cervical cancer, while screening tests (e.g., PAP, HPV testing) can detect any abnormal changes, resulting in early cancer detection (Kim et al., 2018). The vaccination could prevent approximately 29,000 cases of HPV-associated cancers in the U.S every year (Centers for Disease Control and Prevention, 2014b). Cervical cancer prevalence has begun to decline over the past 40 years, owed to both vaccination and screening (Shaw, 2000).

1.3. Economic burden of HPV

Globally, HPV-related diseases are significant and are a source of great economic burden. In the U.S., the HPV-associated prevention and treatment cost was $8 billion before the introduction of the HPV vaccine. The majority (i.e., 6.6 billion) was spent on cancer screening and follow-up care. Another $1 billion was used for cancer treatment, $200 million was spent on recurrent respiratory papillomatosis, and $300 million was spent on treating cases of genital warts (Chesson et al., 2012). According to the CDC, annual HPV-related cancer treatment costs are the second-highest in the U.S., followed by HIV. In the year 2018, approximately $755 million was spent on treating HPV infections in the U.S. (Centers for Disease Control and Prevention, 2021a).

Cancers due to HPV are difficult and expensive to treat. The medical cost of treating cervical cancer depends widely on the stage at which the cancer was identified. For example, women under 65 years of age need approximately $118,000 and women over 65 years of age need $79,000 for treatment during their last years of life (Mariotto et al., 2011). In addition, the survival rate from cervical cancer depends on how early it is diagnosed. For example, if patients are diagnosed with localized cervical cancer, the 5-year survival rate is 92% (American Cancer Society, 2021). Therefore, to reduce the burden of cervical cancer, primary prevention is essential through various programs geared towards increasing HPV vaccine uptake.

1.4. HPV and Hispanic women

Hispanic women in the U.S. are 1.7 times more likely to be diagnosed with HPV infection compared to any other racial groups (African American and non-Hispanic White women) (Javanbakht et al., 2010; Seal et al., 2012). In 2013-2014, the prevalence of any genital HPV infection was 38.5%, and the prevalence of high-risk genital HPV infection was 21.6% among Hispanic women (McQuillan et al., 2017). The known risk factors for HPV infection among Hispanic women include poverty, income inequality, unemployment, undocumented immigration status, low educational attainment, language and cultural barriers, limited health information, and stigma around sexual issues (Centers for Disease Control and Prevention, 2010; Rapid Response Service, 2013).

1.5. HPV and emerging adults

HPV infection prevention is a major public health challenge. Before the age of 25, a high proportion of sexually active women became infected with HPV (Ault, 2006). College-aged emerging adults are at a high risk of developing an HPV infection compared to any other age group (Markowitz et al., 2016). Both high-risk and low-risk HPV infection rates are higher among 20 - 24-year-olds compared to older age groups (Awua et al., 2017). Increased sexual activity (Gorin et al., 2011), having multiple sex partners (Fierros-Gonzalez & Brown, 2002; Jemmott et al., 2005), and risk-taking behavior (e.g., having sex under the influence, paying for sex) (Sabogal et al., 1995a) are possible reasons for increased HPV infection among emerging adults. College students are also at high risk of developing HPV-related diseases and play a key role in transmitting the infection. Moreover, HPV is often an asymptomatic condition, and emerging adults pass the infection to their sexual partners unwittingly.

Many college students do not feel that they are at risk of getting an HPV infection (Gerend & Magloire, 2008; Jones et al., 2017; Sandfort & Pleasant, 2009). This may be because college students are unaware that the virus is spread through skin-to-skin contact and that condoms do not provide complete protection against HPV (Sandfort & Pleasant, 2009). Emerging adults have the freedom to make independent decisions that can influence their long-term health care outcomes (Wood et al., 2018). Therefore, vaccine advocacy is needed for emerging adults to protect them from HPV-associated cancers in the future.

1.6. HPV vaccine

Three HPV vaccines are licensed by the U.S. Food and Drug Administration (FDA). In 2006, the FDA approved the first-generation Gardasil® by Merck & Co., which protects against different HPV types, including 6, 11, 16, and 18 (World Health Organization, 2016a). In 2007, GlaxoSmithKline introduced bivalent Cervarix, which protects against HPV16 and 18. Merck & Co. introduced Gardasil® 9 (nonvalent Gardasil) in 2014, and it protects against HPV types 6, 11, 16, 18, 31, 33, 45, 52, and 58 (World Health Organization, 2016a). Since 2017, only Gardasil® 9 has been available to administer among eligible participants in the U.S. (Immunization Action Coalition, 2020), however, bivalent Cervarix and quadrivalent Gardasil are no longer being distributed. HPV vaccines are administered as intramuscular injections and can be given on the same day as other routine vaccines.

1.7. HPV vaccine recommendation

HPV vaccination is a top public health priority as declared by the President's Cancer Panel (Rimer, 2018). According to the Director General of the World Health Organization (WHO), the HPV vaccine is the best way to prevent HPV-related morbidities and mortalities (United Nations Children's Fund, 2019). The WHO has recommended the vaccine, which was approved by the FDA for 9-26-year-old females in June 2006 (World Health Organization, 2013) and males in October 2009 (Centers for Disease Control and Prevention, 2010). The Advisory Committee on Immunization Practices (ACIP) recommends the HPV

vaccine for both males and females aged 11 to 26, but the vaccine can be administered as early as 9 years old (Meites et al., 2019). Although the vaccine has shown higher efficacy if administered during the adolescent period, however, it can also have high efficacy in preventing infections and precancerous lesions if administered during 18 to 26 years (Paavonen et al., 2009). The CDC has recommended giving the HPV vaccine to 18 - 26 years (males and females) who have not previously been vaccinated (Centers for Disease Control and Prevention, 2013). Emerging adults aged 18-26 have been defined as a catch-up population for the HPV vaccine.

Adolescents who begin the vaccination before their 15th birthday need just two doses, while those who begin later require three doses (Meites, 2016). Adolescents younger than 15 years old receive the second dose of the vaccine between six months and 11 months after the first dose. Individuals who are older than 15 years old receive their second dose within 1-2 months after receiving the first dose and obtain the third dose within six months of the second dose. According to the vaccine protocol, there should be at least a five-month gap (minimum interval) between the first and third doses of the vaccine when administered after the 15th birthday (Centers for Disease Control and Prevention, 2021b). When administered prior to sexual activity and exposure to HPV infection, HPV vaccines are most effective (99%) (Dunne et al., 2014; Markowitz et al., 2014; Valentino & Poronsky, 2016; Yang et al., 2016). Although HPV vaccination is not recommended during pregnancy, an incomplete vaccine series can be completed during the postpartum period.

1.8. HPV vaccine financing

In the U.S., both public and private financial sources are available to cover the cost of the vaccination. According to the Affordable Care Act (ACA), patients are not supposed to bear the cost of the HPV vaccine; instead, private insurance companies need to cover it. Additionally, the vaccine is covered by the public financing system, which includes Medicaid, the Vaccine for Children (VFC) program, the Immunization Grant Program (sec 317 of the Public Health Service Act), and the Children's Health Insurance Program (CHIP) (Kaiser Family Foundation, 2021).

Medicaid covers the vaccine recommended by the Advisory Community for Immunization Practices (ACIP) for ages 19 and 20 as part of an Early and Periodic Screening Diagnosis and Treatment Program (Kaiser Family Foundation, 2021). Adults aged 21 and older are subject to the Medicaid benefit determined by the state. The Vaccines for Children Program (VFC) covers the HPV vaccine for children and adolescents aged 18 and under who are Medicaid-eligible, uninsured, American Indian or Alaska Native, or underinsured (Kaiser Family Foundation, 2021). The immunization grant program provides financial support to the state and local governments to cover the vaccine costs for uninsured adults. Additionally, Merck also offers a vaccine support program in the U.S. for low and middle-income adults (Kaiser Family Foundation, 2021).

1.9. HPV vaccine benefit

The U.S. Preventive Services Task Force recommends performing a pap test every 3 years for women aged between 21 and 29 in addition to vaccination (Curry et al., 2018). In the last 10 years, the rate of cervical cancer has stabilized, and this may be attributed to the increased rate of HPV vaccine uptake. Even though the CDC recommends the routine HPV vaccine for adolescents aged 11 to 13, not all children receive the vaccine during that time. Emerging adults (18-26 years) should be the second priority for the HPV vaccine because it can reduce the cancer disparities and morbidities associated with HPV.

A meta-analysis of 60 million people from 14 high-income countries recently found HPV vaccination has a significant positive impact on reducing genital HPV infections, high-grade cervical lesions, and anogenital warts (Drolet et al., 2019). Additional evidence suggests that countries with more than 50% HPV vaccine coverage have a significant impact on reducing HPV 16/18 infections (RR=0.32 [95% CI 0.19–0.52]), CIN2+ lesions (RR=0.69 [95% CI 0.66–0.73]), and anogenital warts (RR=0.39 [95% CI 0.22–0.71]) in girls aged 15 to 19 (World Health Organization, 2016b).

Human papillomavirus vaccination should be promoted for emerging adults to save lives and eliminate cancer disparities. According to current statistics, 30% of college women who are not sexually active and 42% of women who are sexually active are still HPV-free (Dunne et al., 2007). A total of 72% of women who are not sexually active (30%) and are HPV-free (42%), may benefit from receiving the HPV vaccine as they begin college. If the vaccine could be

given before sexual contact, it could prevent 64% of HPV infections and 90% of cervical cancer cases (Markowitz et al., 2014; Roncancio et al., 2019). The vaccine may also reduce the risk of penile cancer by half, with the incidence of penile cancer expected to fall to 5% by 2050 (Shabbir et al., 2013).

According to a mathematical model study conducted in the United Kingdom (UK), the HPV vaccine can prevent 76% of cancer incidences and 66% of cancer deaths (Kohli et al., 2007). Furthermore, the study anticipated a 95% reduction in high-grade lesions and a 45% reduction in low-grade lesions if the recommended HPV vaccine doses were completed. Finally, Kohli et al. (2007) discovered that 100% HPV vaccine coverage results in a 43% reduction in cervical intraepithelial neoplasia (CIN) lesions (Kohli et al., 2007).

1.10. HPV vaccine safety

Before the FDA licensed the HPV vaccination, several clinical trials were conducted to ensure its safety. The HPV vaccine has been approved in more than 60 countries around the world. The vaccine is safe to use, and no serious side effects have been reported (Huh et al., 2017). No association was found between the HPV vaccine and Guillain-Barré syndrome (GBS) (World Health Organization, 2017). A meta-analysis conducted in 2018 on 26 randomized controlled trials with 70,000 women and girls found no increased adverse events due to HPV vaccination and a decreased risk of pre-cancerous morbidities among young women (Arbyn & Xu, 2018; Arbyn et al., 2018). The vaccine is safe with minimal side effects, such as syncope and skin infections (Centers for

Disease Control and Prevention, 2018a; Markowitz et al., 2014; Sukumaran, 2015).

1.11. HPV vaccine efficacy

The safety, tolerability, and efficacy of the HPV vaccine in humans are well established and documented in the scientific literature (Drolet et al., 2019; Handler et al., 2015; Pomfret et al., 2011). The HPV vaccine is both safe and effective in protecting people from getting high-risk HPV and reduces the incidence of cervical cancer by 76% (Centers for Disease Control and Prevention, 2020b; Kohli et al., 2007). The prevalence of quadrivalent HPV infection in women aged between 14 and 19 years has declined from 11.5% (2003-2006) to 1.1% (2015 – 2018) and among women aged 20 to 24 years has decreased from 18.5% (2003 – 2006) to 3.3% (2015 – 2018) (Rosenblum et al., 2021). Similarly, the 9-valent HPV infection has decreased from 8.4% (2003 - 2006) to 2.3% (2015 – 2018) among women aged between 14 and 19 years old. However, no significant change has occurred among women aged between 20 and 24 years (Rosenblum et al., 2021). Between 2003 and 2010, the prevalence of anogenital warts reduced dramatically among females aged 15 to 29 years (Flagg et al., 2016).

A randomized controlled trial conducted in 18 countries on 14,215 females aged 16 to 26 years found that the HPV vaccine was 97.4% effective in protecting against high-grade cervical, vulvar, and vaginal disease; 96.0% effective at preventing 6-month persistent infection; and 96.7% effective at

preventing 12-month persistent infection (Huh et al., 2017). Additionally, the study also found that the vaccine is 100% effective at preventing cervical intraepithelial neoplasia (CIN) grade 3, adenocarcinoma in situ, or cervical cancer, and 90% effective at preventing cervical and external genital diseases (Huh et al., 2017).

Although the vaccine cannot be used to treat an existing HPV infection, it is recommended to provide the vaccine to anyone under the age of 26 who did not receive the vaccine during their adolescent years. Although the vaccine is less effective among those exposed to HPV infection earlier, it is pretty uncommon for a person to be afflicted with all nine HPV (Immunization Action Coalition, 2020). As a result, the vaccine can protect the individual from different HPV types. While the HPV vaccine can protect individuals from HPV-related morbidities, an incomplete vaccination series reduces the vaccine's efficacy in preventing morbidity (Daley et al., 2010; Dunne et al., 2007; Lefkowitz et al., 2014; Marchand et al., 2013). The duration of protection provided by the HPV vaccine has been determined to be long-lasting. After 8.5 years of observation, a nonvalent HPV 16 trial demonstrated good efficacy and no reduction in HPV vaccination protection (Rowhani-Rahbar et al., 2009).

1.12. HPV vaccination rate

According to the National Center for Health Statistics, the percentage of female emerging adults receiving at least one dose of the vaccine in the U.S. has increased from 36.8% in 2013 to 53.6% in 2018 (Boersma & Black, 2020). Even

though the vaccine initiation rate has increased over time, the vaccine completion rate among women in the U.S. continues to be a concern. In 2016, 51.6% of females aged 19–21 years and 46.6% of females aged 22–26 years had received the HPV vaccine, respectively (Centers for Disease Control and Prevention, 2016b). In 2018, 35.3% of women aged 18 to 26 completed the recommended vaccination series, compared to 25.7% in 2013 (Boersma & Black, 2020). The possible reasons for not completing the vaccine series could be the number of doses needed (i.e., multiple visits needed to complete the vaccine series), and social stigma. Furthermore, healthcare providers' inadequate insurance reimbursement system and lack of a reminder system could be potential healthcare-level barriers to completing the vaccine series (Vadaparampil et al., 2014). Even though HPV vaccine uptake has increased over time, it is low among Hispanic emerging adults compared to non-Hispanic Whites.

In 2018, 36.1% of female Hispanic emerging adults in the United States received an HPV vaccine, compared to 42.1% of non-Hispanic Whites and 36.7% of non-Hispanic Blacks (Boersma & Black, 2020). It has also been found that Hispanic women (48.8%) were less likely to receive the HPV vaccine compared to non-Hispanic White women (57.9%) (Boersma & Black, 2020). HPV vaccination initiation and completion rates are low overall among college students. The vaccine uptake was almost 60% lower among college students (Lee et al., 2018), even though they are at high risk of HPV infection. A study conducted among 406 female college students found that 43% had begun the

vaccine. Out of those 43%, a total of 33% have received a second dose, and only 55% have completed the recommended series (Licht et al., 2010). Previous studies have found that HPV vaccine uptake is poor among Hispanic college students compared to Whites (Cohen & Legg, 2014).

1.13. Facilitators and carriers in HPV vaccine uptake

Several factors may influence emerging adults' decision to acquire the HPV vaccine (Daly et al., 2016). Researchers have documented that preventing an HPV infection is a stronger inducement for emerging adults to acquire the HPV vaccine than cancer protection (Krieger & Sarge, 2013). Besides that, HPV knowledge, vaccine availability, and social and peer influence are the potential factors that impact the HPV vaccination (Abramoff, 2008; Bendik et al., 2011; Bynum et al., 2011; Krawczyk et al., 2012; Nyhan et al., 2012; Perkins & Clark, 2012; Sandfort & Pleasant, 2009). Emotional support is another facilitator for emerging adults to get the vaccine which also impacts their decision-making process. Vaccine support includes encouragement from individuals deemed personally close to them and who have already got the HPV vaccine. A qualitative study discovered people who receive support from family members, relatives, or friends, are more likely to get any vaccine (Loftus et al., 2021). Having good emotional support can help emerging adults get through the process and boost their chances of getting vaccinated against HPV.

The goal of Healthy People 2030 is to reach 80% HPV vaccine coverage among adolescents and young adults (U.S. Department of Health and Human

Services, 2019) however, there is no specific national target for emerging adults. Gender, ethnicity, healthcare inequities, and socioeconomic status are possible barriers to HPV infection and vaccine uptake. Lack of vaccine knowledge, awareness, misinformation about the vaccine, poor communication, concern about vaccine complications, cost of the vaccine, fear of needles, risk perception, and level of insurance coverage have all been studied as factors associated with HPV vaccine uptake among emerging adults (Chiang et al., 2016; Cohen & Legg, 2014; Dibble et al., 2019; Jaiswal et al., 2020; Lim & Lim, 2019; Pierre-Victor et al., 2018). Furthermore, factors such as a lack of awareness that vaccines can be given to people as young as 26 (Oldach & Katz, 2012), a lack of perceived benefit (Wilson et al., 2013), and a lack of a health care professional's recommendation (Gutierrez et al., 2013) may jeopardize overall vaccine uptake. Another obstacle to HPV vaccine uptake is parents' fear that their children may become sexually active at a young age due to HPV vaccination (Lechuga et al., 2016; Luque et al., 2012).

Disparities in HPV vaccine coverage have been discovered among racial and ethnic minorities, as well as among the uninsured (Gelman et al., 2011; Jeudin et al., 2013; Niccolai et al., 2011; Owusu-Edusei Jr et al., 2013). Previous research has mentioned that having access to health care and insurance coverage is positively associated with HPV vaccine initiation and completion (Lu et al., 2018). Furthermore, cognitive habits were discovered to be potential facilitators of HPV vaccination. For example, physician recommendations (Daley et al., 2010; Wilson et al., 2016), perceived severity of HPV-related health

outcomes (Bynum et al., 2011), perceived vaccination benefits (Wilson et al., 2016), perceived risk of HPV infection (Fontenot & Fantasia, 2015), and efficacy of the HPV vaccine (Hodge et al., 2011) were potential facilitators in the vaccine uptake.

The majority of studies have looked at sociodemographic and cognitive characteristics as potential drivers of HPV vaccination uptake. However, no study has yet looked into the impact of cultural factors on HPV vaccine uptake among Hispanics. Hispanics may encounter certain challenges from their surroundings that could be a potential barrier to healthcare-seeking behaviors (e.g., vaccination) (Velasco-Mondragon et al., 2016). For example, traditional gender roles are among Hispanics' core cultural factors and potential barriers to health-seeking behavior and express certain expectations for men and women. Men with higher traditional gender roles reported lower adherence to health-protective behaviors (Gast et al., 2020).

1.14. Knowledge regarding HPV and HPV vaccine

Knowledge regarding HPV infection and HPV vaccination are two distinct domains. HPV infection and vaccine knowledge diffusion varied widely across the population’s individual (e.g., age, gender, education), and social (socioeconomic status, race) levels. In 2019, a nationally representative survey in the U.S. measured knowledge regarding HPV infection and vaccination. It found that almost a total of 54% of men and 80% of women have heard of HPV, and 52.7% of men and 79% of women have heard about the HPV vaccine among

those aged 18 to 26 (Suk et al., 2019). However, 60.1% of men and 31.6% of women do not know that cervical cancer is caused by HPV. The survey found that 92.2%, 89.0%, and 84.7% of men did not know that HPV causes anal, penile, or oral cancers, compared to 79.4%, 77.8%, and 77.6% of women, respectively (Suk et al., 2019).

The HPV vaccine was introduced as a woman's vaccine to prevent most cervical cancers (Mamo et al., 2010). As such, male students may not think they are at risk of developing HPV (Katz et al., 2011) or have been exposed to HPV infection and are unwilling to initiate the HPV vaccine (Giuliano et al., 2011). College students have a lack of knowledge about HPV symptoms and transmission modes (Bertram & Niederhauser, 2008). Research has mentioned that modifying risk perception associated with other cancers besides cervical cancer, like anal, oral, and penile cancer, will increase HPV vaccine uptake (McRee et al., 2010; Newman et al., 2012; Stock et al., 2013; Wheldon et al., 2013).

Several studies did not find any significant association between HPV vaccine knowledge and vaccine uptake (Krawczyk et al., 2015; Walling et al., 2016) with a few exceptions that found HPV vaccine uptake increased with increased levels of HPV vaccine knowledge (Grandahl et al., 2014; Reiter et al., 2013). Knowledge regarding HPV infection and vaccination directly impacts vaccine uptake (Francis et al., 2012). However, little is known about the moderating effect of knowledge regarding HPV infection and HPV vaccination on

cultural determinants like cancer fatalism and vaccine uptake among Hispanic emerging adults.

Most studies have measured HPV infection and vaccination knowledge using a single item, which is not enough to identify the appropriate level of knowledge and its association with vaccine uptake. This study incorporated two separate multi-item questionnaires at the same time to measure knowledge regarding HPV infection and the HPV vaccine. The study has also extended the existing research by testing the moderating effect of knowledge on the relationship between cancer fatalism and vaccine uptake among Hispanic emerging adults.

1.15. Hispanic cultural factors

Identifying the cultural factors of vaccine uptake among Hispanic emerging adults is essential. Cultural attitudes and norms are significant barriers for Hispanics to accessing health care (Velasco-Mondragon et al., 2016), and are negatively associated with different health outcomes, including the HPV vaccination rate (Rapid Response Service, 2013; Seal et al., 2012). A systematic review conducted among immigrants suggests that cultural factors are a potential barrier in the vaccine decision-making process (Wilson et al., 2018). Some relevant cultural factors that may influence health outcomes and health behaviors among Hispanics are traditional gender roles (Nadal, 2017; Nuñez et al., 2016), fatalism (Bustillo et al., 2017; Mier-Chairez, 2020), familism (Corona et al., 2019; Munoz, 2018), and acculturation (Sabogal et al., 1995b).

1.15.1. Fatalism

Fatalism is defined as the belief that nothing can be done to change one's fate, and this belief can be a barrier to healthy behavior practices (Perez-Stable et al., 1992b). Fatalism is a complex phenomenon influenced by cultural, historical, and social variables (Powe, 1995). Fatalistic views are classified into three categories. First, an individual's apparent lack of internal control over external events in their life (Chavez et al., 1997; Davison et al., 1992; Neff & Hoppe, 1993; Straughan & Seow, 1998). Second, the predetermination of a disease or health condition is also referred to as fate, luck, or destiny (Cohen & Nisbett, 1998; Davison et al., 1992; Straughan & Seow, 1998), and finally, the perceptions of powerlessness, hopelessness, and meaninglessness as a result of negative health consequences.

The definition of fatalism varies widely across geography; however, in this study, fatalism has been adopted to measure specifically cancer fatalism. Cancer fatalism is the belief that “mortality from cancer is inevitable and that the disease is beyond an individual’s control” (Niederdeppe & Levy, 2007). Hispanics believe that some health conditions (particularly cancer) are beyond human control and are a predetermined fate decreed by God (Madhivanan et al., 2016). These fatalistic attitudes among some Hispanics are a potential barrier to cancer prevention (e.g., screening and vaccination) (Powe & Finnie, 2003; Straughan & Seow, 1998). Cancer fear is especially high among ethnic minority groups (Robb et al., 2009). According to Ramrez et al. (2013), 62% of Hispanics believe cancer

is not preventable, compared to 33% of Asians, 29% of Blacks, and 22% of Whites (Ramírez et al., 2013).

The *Powe Fatalism Model* was developed by Barbara D. Powe in 1995 (Powe, 1995). The original model was designed to assess the relationship between cancer fatalism and colorectal cancer screening among elderly African Americans. The model also included sociodemographic factors (e.g., age, gender, education, income) and knowledge regarding colorectal cancer as predictors. Previous researchers found that low self-efficacy is associated with health-related fatalism (Petrovic et al., 2011).

Cultural beliefs and attitudes had a significant influence on individual health care utilization and health-seeking behavior (Johnson et al., 2008a). It has been found that culture influences Hispanic women positively towards cervical cancer screening (Johnson et al., 2008a).

Fatalism has been explored as a potential predictor for cancer prevention measures, such as information-seeking behavior and screening (e.g., colorectal cancer screening, Papanicolaou [Pap] tests, and mammography). Crosby et al. found that after controlling for the cost of the vaccine, young women in rural Appalachia are less likely to receive the HPV vaccine compared to urban young women (Crosby et al., 2011). These findings suggest that cultural factors like fatalism might have an indirect effect on the HPV vaccine uptake among emerging adults. However, research on the potential impact of fatalistic attitudes on HPV vaccination uptake as a cancer prevention method has been minimal.

Fatalism is a relevant cultural value for Hispanics, and cancer fear has been associated with fatalism (Robb et al., 2009). This study adopted the *Powe Fatalism Model* to explore the association between cancer fatalism and HPV vaccine uptake. Furthermore, this study has expanded the theory by testing the moderating effect of HPV knowledge and HPV vaccine knowledge on the association between cancer fatalism and HPV vaccine uptake among Hispanic emerging adults.

1.15.2 . Traditional gender roles

Traditional gender roles are a relevant Hispanic cultural factor, that set certain expectations for men and women. Some traditional norms for Hispanic women are that they are expected to be submissive, sexually naïve (Cianelli et al., 2008; Ferrer et al., 2016), virgins until they get married, and trustworthy to their partner (O'Sullivan & Meyer-Bahlburg, 2003). Women are also expected to hide their pain and illness from their families to avoid worry (Ashing-Giwa et al., 2006; Vadaparampil et al., 2004). Traditional gender roles are a representation of unequal power distribution among men and women (Wingood & DiClemente, 2000). It is negatively associated with sexual risk behaviors among Hispanics. For example, Hispanic women with higher traditional gender roles are more likely to obey their partner's decision on condom use compared to any other group (Grady et al., 1999). As such, traditional gender roles expectations may act as a barrier to practicing safer sex behavior.

In this study, traditional gender roles are considered as “different expectations for males (bread-winner, independence, head of household) and females (child-rearing, protection of girls)” (Knight et al., 2010). Qualitative research conducted among Hispanic parents found that traditional gender roles negatively impact the HPV vaccine uptake among their children (Fernandez-Pineda et al., 2020). To date, no quantitative study has been conducted to identify the influence of traditional gender roles on HPV vaccine uptake, especially among Hispanic emerging adults.

In 1987, Robert Connell developed the *Theory of Gender and Power* by adding new concepts called “cathexis” to the existing theories. According to Connell, there are three major dimensions of gender relations, which include (1) sexual division of labor, (2) sexual division of power, and (3) the structure of cathexis. These structures are established at most societal and institutional levels (Wingood & DiClemente, 2000). Gender-based inequality is nothing but the collectivism of all social mechanisms and gender-based expectations of women by society (Wingood & DiClemente, 2000). The economic inequalities between men and women create discrimination, give power to men, and result in poor health outcomes for women. The cathexis is driven by other social concerns regarding women’s impurity and immorality (Wingood & DiClemente, 2000). The *Theory of Gender and Power* has previously been used to examine the exposures, social/behavioral risk factors, and biological properties that increase women's vulnerability to acquiring HIV. However, the researchers have mentioned that the influence of social structure on women's health is challenging

due to cultural norms (Wingood & DiClemente, 2000). Considering the gap, this study adapted the *Theory of Gender and Power* to examine the direct association between traditional gender roles and HPV vaccine uptake. Furthermore, this study has expanded the theory by testing the moderating effect of acculturation on the association between traditional gender roles and HPV vaccine uptake among Hispanic emerging adults.

1.15.3. Acculturation

Acculturation is the process of change in attitudes, values, beliefs, and behaviors of an individual from one culture to another (Williams & Berry, 1991). It could be bi-dimensional as an individual acquires a new culture while potentially preserving the culture of their country of origin (Schwartz et al., 2010; Zea et al., 2003). Coronado has mentioned that acculturation is associated with cultural beliefs and attitudes. *"Knowing acculturation levels allows researchers to identify groups within a culture that may experience differential risks for diseases or have distinct behavioral patterns" (Coronado et al., 2005).*

Acculturation has both positive and negative impacts on an individual's health. A higher level of acculturation is associated with better health outcomes (e.g., physical activity) (Berrigan et al., 2006; Evenson et al., 2004) but could be associated with worse outcomes such as smoking (Chang et al., 2015), alcohol consumption (Caetano et al., 2009), and poor diet (Ayala et al., 2008) among Hispanics. Previous research has indicated that Hispanic women in the U.S. with

higher levels of language acculturation are almost twice as likely to be infected with an HPV infection (Kepka et al., 2010).

1.15.4. Familism

Familism, also known as familismo, is a key value of Hispanic culture that encourages a sense of unity and cohesiveness (Steidel & Contreras, 2003). Familism is a multidimensional construct focusing on the family as a priority. The term was created 60 years ago to reflect an individual's normative commitment to family and relationships (Luna et al., 1996). In this study, familism has been defined as "a cultural value that involves individuals' strong identification with and attachment to their nuclear and extended families, and strong feelings of loyalty, reciprocity, and solidarity among members of the same family" (Villarreal et al., 2005). In the Hispanic family structure, individuals are nurtured to be loyal to the family (Sabogal et al., 1987). Due to familism beliefs, Hispanics have a strong tie between immediate and extended family members, and family obligations (familismo) are emphasized over individual goals and needs (Cianelli et al., 2008; Santisteban et al., 2002). When compared to non-Hispanic Whites, Hispanics put a greater priority on living near and being in close contact with their families (Ferrari, 2002; Ramirez et al., 2004; Villarreal et al., 2005).

Hispanic youth and adults place a great priority on family (Hardway & Fuligni, 2006; Sabogal et al., 1987; Telzer & Fuligni, 2009). College students face considerable societal pressure when it comes to sexual conduct. However, familism has been shown to serve a protective function in sexual health concerns

(Lefkowitz et al., 2016). A high level of familism can influence health outcomes positively by adopting healthy habits or negatively by accepting myths or negative health habits (Rapid Response Service, 2013). A high level of family support positively impacts Mexican American families during times of crisis and psychological distress (Umaña-Taylor et al., 2011). Furthermore, familism has been shown to protect Hispanics from smoking (Escobedo et al., 2018; Kaplan et al., 2001), alcohol misuse (DiBello et al., 2016; Dillon et al., 2013), promote better health behaviors including treatment adherence (Hosch et al., 1995; Johnson et al., 2008b; Lange et al., 2009), encourage cancer screening (Bazargan et al., 2004; Otero-Sabogal et al., 2003; Teran et al., 2007) and prevent sexually risky behaviors (Benavides et al., 2006).

Familism significantly impacts how students make judgments about engaging in sexual activities (Steidel & Contreras, 2003; Stein et al., 2014). Researchers have mentioned that different aspects of familism and their influence on behavior, attitude, and associated factors have been under-studied (Manago et al., 2014), and less is known about the impact on the HPV vaccine uptake. To fill a knowledge gap, this study investigated the relationship between familism and HPV vaccine uptake among Hispanic emerging adults.

According to the *Behavioral Process Model of Familism* (BPMF), familism is a collection of ideas about family members' behavioral standards that motivate youth to engage in familism-consistent actions (Hernández & Bámaca-Colbert, 2016). Hispanic youth with higher familism values are more likely to modify their actions to reflect those values (Hernández & Bámaca-Colbert, 2016). In addition,

familism also influences avoiding negative peers and not getting involved in risky behaviors (Azmitia & Brown, 2002; Holloway et al., 2014). Previous researchers used BPMF while controlling for the sociodemographic variables, found a significant association between familism and psychological adjustment among emerging adults (Lee & Solheim, 2018). The model has previously been used for Hispanic youth (Parke & Buriel, 2008; Stein et al., 2014). However, it has never been tested on emerging adults and their decision-making process for vaccine uptake.

CHAPTER 2. RATIONALE, OVERALL OBJECTIVE, AND HYPOTHESES

2.1. Rationale:

HPV vaccine disparities are the result of a combination of multiple factors. Increasing vaccine uptake can save lives by reducing the prevalence of HPV infection and its associated morbidities, including cancer and genital warts, which ultimately reduces the economic burden of HPV-related cancers. There are several reasons why this study focused on Hispanic emerging adults aged 18 to 26 years old.

First, HPV vaccine uptake among adolescents is poor, which results in a higher number of unvaccinated emerging adults and introduces HPV vaccine disparities. Even though adolescents are the priority group for the HPV vaccine, this is the last opportunity for emerging adults to be vaccinated. Knowing that the age recommendation for vaccine uptake has been increased to 46, most insurance companies do not cover the vaccine after the age of 26. Therefore, the cost of the vaccine becomes a significant barrier to receiving it after age 26. As such, emerging adults can get the vaccine at an affordable cost to protect them from cancers and other morbidities caused by HPV.

Second, college students aged 18 - 26 are an important target population for HPV catch-up vaccination (Fontenot et al., 2014; Patel et al., 2013; Petrosky et al., 2015). The vaccine can protect emerging adults from getting HPV-related cancers in the future. Up to the age of 25, protection against all oncogenic types of cancer is critical (Kohli et al., 2007). Globally, HPV infection is highest among

women under 25 years old (Serrano et al., 2018). Unfortunately, despite a high risk of acquiring HPV infection between 17 to 26 years because of sexual exposure (Centers for Disease Control and Prevention, 2013), HPV vaccine coverage is low in this population (Centers for Disease Control and Prevention, 2018b).

Third, the Hispanic population is the largest ethnic or racial minority group in the U.S. and the fastest-growing. In 2018, according to the United States Census Bureau, 18.3% of the total population represented Hispanics or persons of Latin origin (U.S. Census Bureau, 2018), The Hispanic population is projected to be 28.6% of the total population in the U.S. by 2060 (U.S. Census Bureau, 2017). There was a 43% increase in the Hispanic population from 2000 to 2010, which is more than half of the total growth of the U.S. population (Passel et al., 2011). Hispanics utilize fewer preventive care services compared to other ethnic groups, and having access to healthcare is a challenge for this population in the U.S. In 2014, a total of 30% of Hispanics reported having no health insurance, compared to 11% of non-Hispanic Whites before the implementation of the Affordable Care Act (ACA) (Centers for Disease Control Prevention, 2016). To reduce the economic burden in the future related to HPV-associated morbidities and mortalities among this growing population, vaccine uptake needs to be prioritized.

Finally, *emerging adulthood* is a period of independence where individuals make their own decisions regarding sexual and reproductive health (Arnett & Tanner, 2006). Following reforms in the Affordable Care Act, the Institute of

Medicine and the National Research Council published a report in 2014 to encourage scientists and policymakers to recognize the 18-26-year-old as a distinct demographic with distinctive social, economic, and policy requirements (Bonnie & O'Connell, 2014). The HPV vaccine is available and accessible for emerging adults in the U.S., but poor vaccine uptake raises a question about the influence of culture. Vaccination is "complex and context-specific, varying across time, place, and vaccines" (MacDonald, 2015). Getting the vaccine is not only a behavioral outcome but also a decision-making process that involves individual, cultural, and social factors (Dubé et al., 2013; Hobson-West, 2003; Streefland et al., 1999). Previous researchers have primarily focused on the beliefs and self-efficacy of HPV vaccine uptake among females aged 13-26 years old. However, these studies have not considered how cultural factors can influence the decision-making process of HPV vaccine uptake. Cultural beliefs and norms are potential barriers for Hispanics to accessing healthcare (Velasco-Mondragon et al., 2016). The majority of research has focused on parents' cultural factors and their influence on their children's HPV vaccine uptake, but did not examine the influence of cultural factors among emerging adults and HPV vaccine uptake.

To address these gaps, this study examined the association between sociocultural factors, such as traditional gender roles, fatalism (e.g., cancer fatalism), familism, and HPV vaccine uptake among Hispanic emerging adults. The study adapted the theory of the *Powe Fatalism Model* (Powe, 1995), the *Theory of Gender and Power* (Wingood & DiClemente, 2000), and the *Behavioral*

Process Model of Familism (Hernández & Bámaca-Colbert, 2016) to fulfill the study aims.

2.2. Research objective:

The objective of this study is to examine the association between HPV vaccine uptake and sociocultural factors for Hispanic emerging adults attending college. The central hypothesis is that sociocultural factors will contribute to HPV vaccine uptake among emerging adults.

2.3. Research aims and hypotheses:

Aim 1: Guided by the *Powe Fatalism Model,* the association between cancer fatalism and HPV vaccine uptake will be examined among Hispanic emerging adults, and the extent to which HPV knowledge and HPV vaccine knowledge moderate this association (see Figure 1).

Hypothesis 1a: Higher cancer fatalism will be associated with lower HPV vaccine uptake.

Hypothesis 1b: The relationship between cancer fatalism and HPV vaccine uptake will be stronger for Hispanics with lower HPV knowledge.

Hypothesis 1c: The relationship between cancer fatalism and HPV vaccine uptake will be stronger for Hispanics with lower HPV vaccine knowledge.

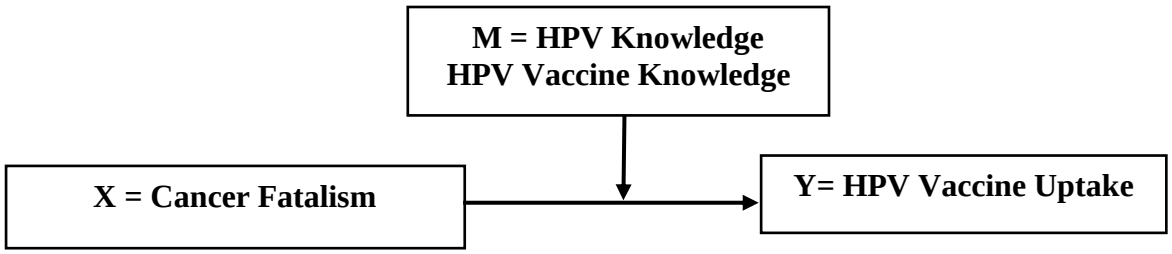

Figure 1: Conceptual Model: The moderating effect of HPV knowledge and HPV vaccine knowledge on the relationship between cancer fatalism and HPV vaccine uptake

X = Focal Predictor, M= Moderating Variable, Y = Outcome Variable

Aim 2: Guided by the *Theory of Gender and Power,* the association between traditional gender roles and HPV vaccine uptake will be examined among Hispanic emerging adults, and the extent to which acculturation may moderate this association (see Figure 2).

Hypothesis 2a: Higher levels of traditional gender roles will be associated with lower HPV vaccine uptake.

Hypothesis 2b: The relationship between traditional gender roles and HPV vaccine uptake will be stronger for Hispanics with lower acculturation.

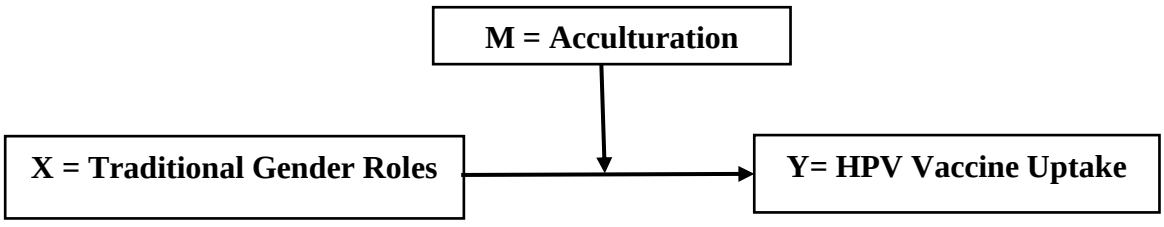

Figure 2: Conceptual Model: The moderating effect of acculturation on the relationship between traditional gender roles and HPV vaccine uptake

X = Focal Predictor, M= Moderating Variable, Y = Outcome Variable

Aim 3: Guided by the *Behavioral Process Model of Familism,* the association between familism and HPV vaccine uptake will be examined (see Figure 3).

Hypotheses 3a: Higher levels of familism will be associated with higher HPV vaccine uptake.

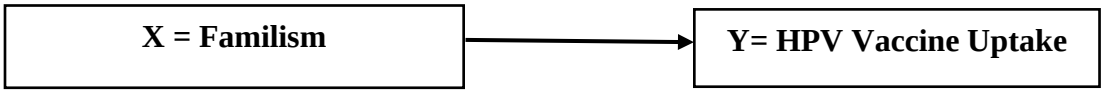

Figure 3: Conceptual Model: The relationship between familism and HPV vaccine uptake

X = Focal Predictor, Y = Outcome Variable

CHAPTER 3: METHODOLOGY

3.1. Study design

A cross-sectional study was conducted using data obtained from the *Project on Latino Emerging Adults and Prevention Science* (Project LEAPS). Data for Project LEAPS were collected using convenience sampling methods from Hispanic emerging adults aged 18 to 26 years old.

3.2. Study site

The study was conducted at Florida International University (FIU) in Miami, Florida, and the University of Houston, in Houston. Texas. Texas has the second-largest Hispanic population in the U.S., with an estimated 28.7 million people. Florida, on the other hand, ranked 3rd in terms of the total number of Hispanic populations, with an estimated 21.3 million people. However, Hispanics in these two states have significant differences with regards to their country of origin and/or the birthplace of their ancestors. The majority of the Hispanic population in Florida is Cuban, whereas in Texas it is Mexican (PH Center, 2004). As the country of origin plays a critical role in attitude and cultural practice, our study sites covered a diverse population of Hispanic origins.

In addition, Hispanic student enrollment has increased substantially in institutions of higher education during the past four decades. Previous research has found that college enrollment is associated with different health outcomes among emerging adults aged between 18 and 26 years (Savaiano, 2021).

Conducting the study in two higher education institutes in the two states with the highest number of Hispanics also captured a diverse Hispanic population.

Florida International University (FIU) is a public research university located in Miami-Dade County, in the southern part of Florida. The majority of the people in Miami-Dade County are Hispanic. According to the United States Census Bureau, Hispanics make up 69% of all residents in Miami Dade County (U.S. Census Bureau, 2019b). At FIU, 63.9% of the total enrolled students are Hispanic or Latinx, which is 5.27 times more than the non-Hispanic White students at FIU (Florida International University, 2016).

The University of Houston (UH) is also public research university and is the 3rd largest school in northwestern Harris County, Texas (Misachi, 2019). According to the U.S. Census, 43% of the total population in Harris County is Hispanic (U.S. Census Bureau, 2019a). In UH, 44% of the total enrolled students are Hispanic or Latinx, which is 1.7 times higher than non-Hispanic White students in UH (University of Houston, 2016).

3.3. Data collection

A total of 791 participants (FIU *n* = 647; UH *n* = 123) completed an online survey between August and December 2020. Participants were recruited through the SONA subject pool, which is the internal research participation system at the selected universities. Students completed a pre-screening form to determine if they met eligibility criteria before enrolling in the study. Each student was assigned a randomly generated ID number. Students were asked to read an

online consent form in English and to check a consent box if they were willing to take part in the study. Students who did not consent were automatically directed to the end of the survey; otherwise, if students consented to participate, then they were directed to the full survey in Qualtrics. All questions were voluntary, and participants had the option to skip any questions they did not wish to answer. The survey took approximately an hour to complete, and participants received one research credit as an incentive for their participation.

3.4. Study power

Study power was calculated using PASS2019 statistical software, (Hsieh et al., 1998). Logistic regression of a binary response variable (Y=HPV uptake) on a continuous, normally distributed variable (X=cancer fatalism, traditional gender roles, and familism) with a sample size of 400 observations achieved an 80% power at a 0.05 significance level to detect an odds ratio when the prevalence of Y is given. A change in Prob (Y=1) from the baseline value is given below.

Detectable odd ratio for continuous exposure

	HPV vaccine Prevalence			
Population	Initiation	OR	Completion	OR
Women	.50	1.3	.30	1.5

Due to the small number of samples in initiation and completion, this study has combined both the initiation and completion together as HPV vaccine uptake.

3.5. Eligibility criteria

The eligibility criteria to participate in this study were as follows:

1. Adults between the ages of 18 and 26 who self-identify as Latinx/Hispanic.
2. A current Florida International University or University of Houston student.
3. Capable of reading and understanding English.
4. Students willing to provide online informed consent.

3.6 Exclusion criteria

Students who were not included in the study were women who are currently pregnant or breastfeeding, as the CDC does not recommend the HPV vaccine for pregnant women (Centers for Disease Control and Prevention, 2016a).

3.7. Ethical consideration

The current study obtained approval from the Institutional Review Boards of FIU and UH. All participants provided online informed consent to ensure voluntary participation. The informed consent included information that participants had the right not to answer any question and that they could withdraw themselves at any time. A de-identified, password-protected database was used to store all the study data.

3.8. Outcome variables

HPV vaccine uptake

Self-reported HPV vaccine uptake was identified by asking the following question.

1. “HPV vaccine (for example Gardasil, Silgard, or Cervarix) is recommended, but usually not required, and is given in a series of 2 or 3 shots based on your age. Which of the following best describes your HPV vaccination status”
    0. I have not received any vaccine series.
    1. I have started, but not yet completed the vaccine series.
    2. I have completed the vaccine series.
    3. I don’t know my vaccination status.

Emerging adults who received at least one dose of the HPV vaccine or completed the series were categorized as “Yes = 1”. Those who did not know their vaccine status or did not receive any doses of the HPV vaccine were categorized as “No = 0”. This question was adopted from a previous study (Preston & Darrow, 2019). The response, “refuse to answer”, was classified as missing and excluded from the analysis.

3.9. Exposure variables

Aim 1: Cancer fatalism was the focal predictor, which was assessed using eight items with a Likert-type response scale (Villarreal et al., 2005). Participants

were asked to choose the best answer that most applied to them from each question. The scale had the following items:

1. Cancer is beyond my control.
2. Cancer of any kind is a death sentence.
3. Cancer is almost always fatal.
4. Cancer is a disease that cannot be avoided.
5. If it were fated for me to get HPV-related cancers, getting vaccinated against HPV would not prevent it.
6. People in my family get cancer so I will probably get it also.
7. Faith is all I need to prevent diseases and illnesses.
8. I am not in control of my own health.

Participants had to agree/disagree with the items on a five-point scale from 1 “Strongly Disagree” to 5 “Strongly Agree”. Items were summed up to calculate the total score, with a higher score indicating higher cancer fatalism. The scale exhibited below the recommended internal consistency with a coefficient (Cronbach) alpha of .67.

Response scale

Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
1	2	3	4	5

Additionally, HPV knowledge and HPV vaccine knowledge were the moderators for this aim, which was assessed with a multiple-items scale as described below. HPV knowledge was assessed using an 18-item scale. Item 1 –

15 was adapted from a previous study (Charalambous et al., 2020) and 16 – 18 were created by the lead author for this study. The scale has the following eighteen- items with a binary response of “False = 0 and True = 1”. Participants received one point if they answered the question correctly; otherwise, it was marked as 0. Items were summed up to calculate the total HPV knowledge score, with a higher score indicating higher HPV knowledge.

1. HPV is very rare.
2. A person infected with HPV always has visible signs or symptoms.
3. HPV can cause cervical cancer.
4. HPV can be transmitted through genital contact.
5. There are many types of HPV.
6. HPV can cause HIV/AIDS.
7. HPV is transmitted through sexual intercourse.
8. HPV can cause genital warts.
9. Men cannot get HPV.
10. Using condoms reduces the risk of getting HPV.
11. HPV can be cured with antibiotics.
12. Having multiple sexual partners increases the risk of being infected with HPV.
13. Most sexually active people will get HPV at some point in their lives.
14. A person could have HPV for years without knowing it.
15. Engaging in sexual activity at a young age increases one’s risk of getting HPV.

16. HPV can cause oral cancer.
17. HPV can cause anal cancer.
18. HPV can cause penile cancer.

HPV vaccine knowledge was assessed using a 10-item scale. Item 1 – 6 (Charalambous et al., 2020) and item 7 – 10 (Perez et al., 2016) were adapted from previous studies. The scale has the following ten items with a binary response as “False = 0 and True = 1”. Participants received 1 point if they answered the question correctly, otherwise, it was marked as 0. Items were summed up to calculate the total HPV vaccine knowledge score, with a higher score indicating higher HPV vaccine knowledge.

1. The human papillomavirus (HPV) vaccine has been included in the National Immunization Schedule in the U.S.
2. For maximum protection, individuals need two or three doses of the HPV vaccine.
3. The HPV vaccine offers protection against all sexually transmitted infections.
4. Someone who has had the HPV vaccine cannot develop cancers caused by HPV.
5. The HPV vaccine protects against genital warts.
6. Girls who have had the HPV vaccine do not need Pap tests when they are older.
7. The HPV vaccine is most effective if given to people who have never had sex.

8. You can cure HPV by getting the HPV vaccine.
9. The HPV vaccine is approved and recommended for females aged 9-26 years.
10. The HPV vaccine is approved and recommended for males aged 9-26 years.

Aim 2: Traditional gender roles were the focal predictor for Aim 2, which was assessed using a subscale of the Mexican American Cultural Values for Adolescents and Adults scale (Knight et al., 2010). The scale is focused on different expectations for both males (breadwinner, independence, head of the household) and females (child-rearing, protection of girls). The scale has the following five items with Likert-type responses:

1. Men should earn most of the money for the family so women can stay home and take care of the children and the home.
2. Families need to watch over and protect teenage girls more than teenage boys.
3. It is important for the man to have more power in the family than the woman.
4. Mothers are the main people responsible for raising children.
5. A wife should always support her husband's decisions, even if she does not agree with him.

Participants had to agree or disagree with the items on a five-point scale from 1 "Not at all" to 5 "Completely". Items were summed up to calculate the total

score, with a higher score indicating greater adherence to traditional gender roles. The scale exhibited adequate internal consistency with a coefficient (Cronbach) alpha of 0.73. Participants were asked to choose the best answer that most applied to them out of each question.

Response scale

Not at All	A Little	Somewhat	Very Much	Completely
1	2	3	4	5

Moreover, this aim also examined the moderating effect of acculturation measured with the Brief Acculturation Rating Scale for Mexican Americans-II for children and adolescents (Bauman, 2005). This scale was used to identify the level of acculturation among elementary school students. The scale has the following ten items with Likert-type responses, including:

1. I enjoy Spanish language TV.
2. I enjoy speaking Spanish.
3. I enjoy Spanish language movies.
4. I speak Spanish.
5. My thinking is done in the Spanish language.
6. I enjoy reading in Spanish.
7. I speak English.
8. I write in English.
9. I enjoy English language movies.
10. My thinking is done in the English language.

Participants had to select on a five-point scale from 1 “Not at All” to 5 “Almost always.” The scale consists of two subscales: the Anglo Oriented Scale (AOS) and the Mexican Oriented Scale (MOS). The total score of the MOS subscale was calculated by adding items from 1- 6 and the AOS scale was calculated by adding items from 7 – 10. The acculturation score was calculated by subtracting the average score of AOS from MOS. The subscales exhibited adequate internal consistency with a coefficient (Cronbach) alpha of 0.7 for AOS and 0.9 for MOS. Participants were asked to choose the best answer that most applied to them out of each question.

Response scale

Not at All	Very Little	Moderately	Very Often	Almost Always
1	2	3	4	5

Aim 3: Familism was the focal predictor for Aim 3, which was assessed using the Pan Hispanic Familism Scale (Villarreal et al., 2005). The scale was created to measure attitudinal familism values. The scale has the following five items with a Likert-type response, including:

1. My family is always there for me in times of need.
2. I am proud of my family.
3. I cherish the time I spend with my family.
4. I know my family has my best interests in mind.
5. My family members and I share similar values and beliefs.

Participants had to agree/disagree with the items on a five-point scale from 1 “Strongly Disagree” to 5” Strongly Agree.” Items were summed to calculate the total score with a higher score indicating higher familism values. The scale exhibited adequate internal consistency with a coefficient (Cronbach) alpha of .90. Participants were asked to choose the best answer that most applied to them from each question.

Response scale

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

3.10. Confounder variables

We adjusted for the potential confounding of several sociodemographic variables. These variables were selected based on prior literature that assessed vaccine uptake (Kessels et al., 2012; Lechuga et al., 2016). These sociodemographic variables included age (0= Younger, 1= Older), nativity (0 = U.S. born, 1 = Foreign born), Hispanic origin (0 = Caribbean, 1= South American, 2= North and Central American), employment status (0 = Unemployed, 1 = Employed), health insurance (0 = Uninsured, 1 = Insured), covered by their parents insurance (0= No, 1 = Yes), economic condition (0 = Not enough money, 1 = enough money), emotional support for HPV vaccine (0 = Disagree, 1 = Agree).

Age: Participants were asked “how old are you” to capture their age. They have the option to choose between 18 and 26 years of age. For this study, age was

categorized as younger (age between 18 and 20 years) and older (age between 21 to 26 years) following previous research (Laz et al., 2013). The reason behind categorizing age into these levels is that they have distinctive features of early and later emerging adulthood. In early emerging adulthood, individuals usually live with their parents, might be dating multiple people, and mostly engage in short-term relationships (Wood et al., 2018). Hence, this might result in high risk-taking sexual behavior, which is a risk factor for HPV. On the other hand, towards the end of the emerging adulthood period (21-26 years old), they become more independent and try to establish long-term relationships (Wood et al., 2018).

Nativity: Participants were asked “Which of the following describes you best” to assess their generation in the U.S. They were given the following options.

0. 1st Generation = You were born in a Latin American country.
1. 2nd Generation = You were born in the USA; either parent was born in a Latin American country.
2. 3rd Generation = You and both your parents were born in the USA, and all grandparents were born in a Latin American country.
3. 4th Generation = You and both your parents were born in the USA, and at least one grandparent was born in the USA.
4. 5th Generation = You and both your parents were born in the USA, and all grandparents were born in the USA.

Nativity was categorized into two groups (0 = Foreign-born, 1 = U.S.-born). All participants that were born out of the U.S. were labeled as foreign-born.

Hispanic origin: Participants were asked “Which of the following Hispanic groups describes you best” and provided the list of countries. They were also given a blank place to write the name of the country if that was not included in the list. For this study, Hispanic origin was categorized into three groups (0 = Caribbean, 1 = South American, 2 = North and Central American) following the Latin American political geography (Encyclopaedia Britannica Inc, 2021).

Employment: To assess the employment status of the students, the study asked “what is your current employment status?” They had the option to choose to be full-time, part-time, or unemployed. For the purpose of this study, we have merged both full-time and part-time together. The employment status was categorized into two groups (0 = Unemployed, 1 = Employed).

Health insurance: Students were asked “what is your primary source of health insurance” to capture their health insurance status. The following options were given to them:

0 I have a college/university student health insurance plan.

1 I have a private health insurance.

2 I am covered by my employer-based plan (or my spouse/partner’s employer-based plan).

3 I have Medicaid, Medicare, SCHIP, or VA/Tricare coverage .

4 I bought a plan on my own.

5 I don’t have health insurance.

6 I don't know if I have health insurance.

7 I have health insurance, but I don't know the primary source.

For this study, those who mentioned having any kind of insurance were merged. The health insurance variable was categorized into two groups (0 = Uninsured, 1 = Insured).

Covered by parent's insurance: This is an exploratory variable included in this study to measure whether being under parent's health insurance is a potential barrier to getting the HPV vaccine for emerging adults. Participants were asked "are you covered by your parent's health insurance" and given the choice to answer (0 = No, 1 = Yes).

Financial condition: Participants were asked "in general, would you say that you have: "more money than you need", "just enough money for your needs" and "not enough money to meet your needs" to capture their financial condition (de Castro et al., 2010). Participants who mentioned they have more money than they need or just enough money for their needs were merged. The financial condition was categorized into two groups (0 = Not enough money to meet needs, 1 = Enough money to meet needs).

Emotional support to get vaccinated: This is an exploratory item that was included in this study to assess the emotional social support, particularly focusing on the HPV vaccine. Participants were asked, "Most people important to me

(e.g., parents, friends, partner) supported or would support me emotionally to get the HPV vaccine". They had to agree/disagree with the items on a five-point scale from 1 "Strongly Agree" to 5 "Strongly Disagree." For this study, individuals who answered, "Strongly Agree" and "Agree" were merged into one group and those that answered "Neither agree/nor disagree", "Disagree", and "Strongly Disagree" were merged in another group. The emotional support for the HPV vaccine uptake was categorized into two groups (0 = Disagree, 1 = Agree).

Response scale

Strongly Agree	Agree	Neither Agree/ Disagree	Disagree	Strongly Disagree
1	2	3	4	5

3.11. Data analysis

The study focused on collecting data on HPV vaccine uptake for female Hispanic emerging adults aged between 18 and 26. Multiple logistic regression was used to examine the factors associated with HPV vaccine uptake and stratified it by study site, after controlling for the potential confounders. Data analysis was performed in three steps. Descriptive statistics, including means and standard deviations for continuous variables (e.g., cancer fatalism, traditional gender roles, and familism) were calculated. Frequencies and proportions for all categorical variables were conducted (e.g., age, nativity, employment status, health insurance, covered by parent's insurance, financial condition, and HPV vaccine support).

In the second step, univariate analyses were performed to assess the crude association between the focal predictors (e.g., cancer fatalism, traditional gender roles, and familism), sociodemographic variables (age, nativity, employment status, health insurance, covered by parent's insurance, financial condition, and HPV vaccine support), and self-reported HPV vaccine uptake. Chi-square test was used to evaluate the association between vaccine uptake and the categorical variables (e.g., age, nativity, employment status, health insurance, covered by parent's insurance, financial condition, and HPV vaccine support). The independent sample *t*-test was used to measure the mean difference between continuous variables (e.g., traditional gender roles and cancer fatalism) and vaccine uptake. The level of significance $\alpha=0.05$ was used during the univariate analysis. All independent variables were assessed by variant inflation factors (VIF) for multi-collinearity. A VIF>3 was taken as a violation of the multicollinearity assumptions (Hair et al., 2019).

A multiple logistic regression was performed, stratified by the study site, to assess the association between focal predictors (e.g., cancer fatalism, traditional gender roles, and familism) and outcome (HPV vaccine uptake) while controlling for the effect of potential covariates. Predictor variables were grouped and entered into the logistic regression model in a block-wise manner. In the first block, sociodemographic variables were entered, followed by health insurance in the second block. Next, in the third block focal predictors (e.g., cancer fatalism, traditional gender roles, and familism) were entered, followed by the moderating variables in the fourth block. In the final block, the interaction between focal

predictors and moderating variables was entered. Before entering the moderating variables in the final block, all the moderating variables were mean-centered to determine the extent to which they uniquely predicted sociocultural factors and HPV vaccine uptake, controlling for other predictors.

Three independent multiple logistic regression models were used to examine the association between focal predictors and HPV vaccine uptake after adjusting for potential confounders. The first model (equation 1) examined the association between cancer fatalism and HPV vaccine uptake and the moderating effect of HPV knowledge and HPV vaccine knowledge on the relationship. The second multiple logistic regression model (equation 2) assessed the association between traditional gender roles and HPV vaccine uptake and the moderating effect of acculturation on the relationship. The third multiple logistic regression model (equation 3) examined the association between familism and HPV vaccine uptake after adjusting for the potential confounders.

Model 1:

$$HPV\ vaccine\ uptake = \beta_0 + \beta_1 age + \beta_2 Nativity + \beta_3 Hispanic\ Origin + \beta_4 Emplpyment + \beta_5 Financial\ stability + \beta_6 Emotional\ Support + \beta_7 Health\ Insurance + \beta_8 Parents\ Insurance + \beta_9 Cancer\ Fetalism + \beta_{10} HPV\ knowledge + \beta_{11} Cancer\ Fatalism\ X\ HPV\ knowledge + \epsilon$$ ….Equation 1

Model 2:

$$HPV\ vaccine\ uptake = \beta_0 + \beta_1 age + \beta_2 Nativity + \beta_3 Hispanic\ Origin + \beta_4 Emplpyment + \beta_5 Financial\ stability + \beta_6 Emotional\ Support + \beta_7 Health\ Insurance + \beta_8 Parents\ Insurance + \beta_9 Traditional\ Gender\ Role + \beta_{10} Acculturation + \beta_{11} Traditonal\ Genderr\ role\ X\ Acculturation + \epsilon$$ ….Equation 2

Model 3:

$$HPV\ vaccine\ uptake = \beta_0 + \beta_1 age + \beta_2 Nativity + \beta_3 Hispanic\ Origin + \beta_4 Emplpyment + \beta_5 Financial\ stability + \beta_6 Emotional\ Support + \beta_7 Health\ Insurance + \beta_8 Parents\ Insurance + \beta_9 Familism + \epsilon$$ ….Equation 3

Adjusted Odds Ratio (aOR) and 95% confidence intervals (CI) from the estimated logistic regression analysis were calculated. All tests were two-sided with an alpha level of 0.05. All analyses conducted were stratified by study site to observe differences in HPV vaccine uptake among diverse Hispanic origins. All

the data analyses were performed using SPSS v25 (IBM, Armonk, NY, USA) (Wagner III, 2019).

CHAPTER 4: RESULTS

The purpose of our study was to examine the sociocultural factors associated with HPV vaccine uptake among female Hispanic emerging adults. The background of the problem has been discussed in detail in Chapter One, including descriptions of HPV, the HPV vaccine, the importance of the HPV vaccine, the current status of HPV vaccination among Hispanic emerging females, and how cultural factors influence health behavior among this population. The objectives of the study were explained in Chapter Two. The methodology of the study was described in Chapter Three. The study findings, including the socio-demographic characteristics of the study population and cultural factors that influence the HPV vaccine uptake, are described in this chapter (Chapter Four).

4.1. Characteristics of the study participants

A total of 791 female Hispanic emerging adults aged between 18 to 26 years participated in the study. Due to missing data on the HPV vaccination uptake variable, 21 participants were eliminated during the data cleaning step. Because less than 5% of the data in this study was missing, the potential impact of missing data was negligible, and cases lacking outcome data were excluded from the analysis (Novotny et al., 2021). Of the available 770 participants, 84% (*n* = 647) were from Florida International University (FIU) and 16% (*n* = 123) were

from the University of Houston (UH). **Table 1** shows the sociodemographic characteristics of the study population per study site (FIU & UH).

The average age of the study participants was 21.21 years (*SD* = 2.24). At FIU, 57% (*n* = 379) of the students were between the age of 21 and 26 years old (older), while 43% (*n* = 287) were between the ages of 18 and 20 years old (younger). In UH, on the other hand, the population was approximately equally distributed between the older (49.6%) and younger (50.4%) groups. The majority of FIU (61.1%) and UH (82.59%) participants were born in the U.S. At FIU, 68.1% of study participants were from the Caribbean, 16.9% were South American, and 15.1% were North and Central American. In UH, however, 89.4% of study participants are from North and Central America, 8.9% from South American, and 1.6% from the Caribbean. More than 60% of FIU (61.1%) and UH (66.9%) participants were employed. At FIU, 87.9% of study participants had health insurance, compared to 65.3% of UH. Approximately 62.5% of the FIU participants and 53.4% of the UH participants were covered by their parents' health insurance. The majority of FIU (71.9%) participants and UH (75.6%) participants reported having enough money to meet their needs. A total of 77.9% of FIU participants and 69.3% of UH participants agreed to have emotional support for HPV vaccine uptake.

Table 1: Sociodemographic characteristics (categorical) of the study population by study site

Variables		*Florida International University (FIU)* n (%)	*University of Houston (UH)* n (%)
Age			
	21 – 26 Years	379 (56.9)	62 (49.6)
	18 – 20 Years	287 (43.1)	63 (50.4)
Nativity*			
	US – Born	398 (61.1)	102 (82.9)
	Foreign – Born	253 (38.9)	21 (17.1)
Hispanic Origin*			
	North & Central American	91 (15.1)	110 (89.4)
	South American	102 (16.9)	11 (8.9)
	Caribbean	411 (68.0)	2 (1.6)
Employment Status			
	Employed	405 (61.1)	83 (66.9)
	Unemployed	258 (38.9)	41 (33.1)
Health Insurance			
	Yes	558 (87.9)	77 (65.3)
	No	77 (12.1)	41 (34.7)
Under Parent's Insurance			
	Yes	403 (62.5)	63 (53.4)
	No	242 (37.5)	55 (46.6)
Economic Condition			
	Enough money	462 (71.9)	90 (75.6)
	Not enough money	181 (28.1)	29 (24.4)
HPV Vaccine Support			
	Agree	479 (77.9)	79 (69.3)
	Disagree	136 (22.1)	35 (30.7)

*Valid %

4.2. HPV vaccine uptake among study participants

Table 2 shows the HPV vaccine uptake among the study participants. Approximately, 56% (*n* = 363) of FIU participants and 45% (*n* = 56) of UH participants received at least one dose of the HPV vaccine. A chi-square test of independence was performed to examine the association between the study site and HPV vaccine uptake. The results indicated a statistically significant association between study site and HPV vaccine uptake [X^2 (1, *n* = 770) = 4.66, *p* = 0.03].

Table 2: HPV vaccine uptake among study participants by study site

Variable		**HPV Vaccination Status**		
		Unvaccinated ***n*** **(%)**	**Vaccinated** ***n*** **(%)**	***P-value***
Study Site				
	FIU	284 (43.9)	363 (56.1)	**0.03**
	UH	67 (54.5)	56 (45.5)	

Note: Bold estimates indicate statistical significance at $p < 0.05$.
Vaccinated =received at least one dose of the HPV vaccine

4.3. Sociodemographic factors and HPV vaccine uptake

Table 3 summarizes the findings of a bivariate analysis of socio-demographic factors and the HPV vaccine. Among FIU participants, the significant factors associated with the HPV vaccine uptake were cancer fatalism ($p < 0.04$), traditional gender roles ($p < 0.01$), and emotional support for the HPV vaccine ($p < 0.001$). Among UH participants, the significant factors associated with HPV vaccine uptake were having health insurance ($p < 0.04$) and emotional support for HPV vaccine uptake ($p < 0.01$).

Table 3: Association between sociodemographic factors, cultural factors and HPV vaccine uptake by study site

Variable	FIU (*n* = 647) HPV Vaccine			UH (*n* = 123) HPV Vaccine		
	Unvaccinated *n* (%)	**Vaccinated *n* (%)**	***p value***	**Unvaccinated *n* (%)**	**Vaccinated *n* (%)**	***p value***
Cancer Fatalism	281 (44.0)	357 (56.0)	**0.04**	67 (54.5)	56 (45.5)	0.29
Traditional Gender Roles	284 (44.0)	361 (56.0)	**0.01**	67 (54.5)	56 (45.5)	0.44
Familism	282 (44.0)	359 (56.0)	0.84	66 (54.1)	56 (45.9)	0.14
Age						
20 – 26 Years	163 (57.4)	205 (56.5)	0.81	30 (44.8)	31 (55.4)	0.24
18 – 20 Years	121 (42.6)	158 (43.5)		37 (55.2)	25 (44.6)	
Nativity						
US – Born	170 (62.0)	218 (60.9)	0.77	54 (81.8)	47 (85.5)	0.59
Foreign – Born	104 (38.0)	140 (39.1)		12 (18.2)	8 (14.5)	
Hispanic Origin						
North & Central American	38 (14.9)	50 (15.1)	0.99	60 (90.9)	48 (87.3)	0.81
South American	43 (16.9)	56 (16.9)		5 (7.6)	6 (10.9)	
Caribbean	174 (68.2)	226 (68.1)		1 (1.1)	1 (1.8)	
Employment Status						
Employed	170 (60.3)	224 (61.7)	0.71	44 (65.7)	37 (67.3)	0.85
Unemployed	112 (39.7)	139 (38.3)		23 (34.3)	18 (32.7)	
Health Insurance						
Yes	232 (86.6)	315 (89.2)	0.31	36 (56.2)	39 (75.0)	**0.04**
No	36 (13.4)	38 (10.8)		28 (43.8)	13 (25.0)	

Table 3: Continued

Variable	FIU (*n* = 647) HPV Vaccine			UH (*n* = 123) HPV Vaccine		
	Unvaccinated *n* (%)	**Vaccinated *n* (%)**	***p value***	**Unvaccinated *n* (%)**	**Vaccinated *n* (%)**	***p value***
Under Parent's Insurance						
Yes	166 (61.3)	229 (63.8)	0.52	34 (54.8)	27 (50.0)	0.60
No	105 (38.7)	130 (36.2)		28 (45.2)	27 (50.0)	
Economic Condition						
Enough money	196 (71.0)	254 (72.6)	0.67	46 (74.2)	42 (76.4)	0.79
Not enough money	80 (29.0)	96 (27.4)		16 (25.8)	13 (23.6)	
Emotional Support for HPV vaccine						
Agree	177 (70.0)	290 (83.3)	**<0.00**	36 (59.0)	42 (82.4)	**0.01**
Disagree	76 (30.0)	58 (16.7)		25 (41.0)	9 (17.6)	

Note: Bold estimates indicate statistical significance at $p < 0.05$.

4.4. Sociocultural factors and HPV vaccine uptake

The average scores of the focal predictors by vaccine uptake status (vaccinated and unvaccinated) are presented in **Table 4.** The average score for cancer fatalism among vaccinated and unvaccinated participants in FIU was 10.10 (*SD* = 5.15) and 10.95 (*SD* = 5.23). Unvaccinated participants in FIU had significantly higher scores in cancer fatalism compared to vaccinated participants ($p = 0.04$). Although unvaccinated participants in the UH had higher mean scores of cancer fatalism, the difference did not reach statistical significance [vaccinated VS unvaccinated: 10.46 (*SD* = 5.80) VS 11.58 (*SD* = 5.80); $p = 0.29$].

The average scores of traditional gender roles among vaccinated participants at FIU were 7.68 (*SD* = 3.13), whereas the score was 8.41 (*SD* = 4.00) for unvaccinated participants. A significant difference in the scores of traditional gender roles between vaccinated and unvaccinated participants was found among FIU participants ($p = 0.01$). The average scores in traditional gender roles among vaccinated and unvaccinated participants in UH were 8.18 (SD = 4.16) and 8.76 (SD = 4.01), respectively. No significant difference in traditional gender roles was observed among UH participants ($p = 0.44$).

Vaccinated participants in FIU had slightly higher familism, [vaccinated VS unvaccinated: 21.10 (*SD* = 4.22) VS 21.03 (*SD* = 4.22)], whereas unvaccinated participants in UH had higher familism [vaccinated VS unvaccinated: 18.80 (*SD* = 3.89) VS 20.77 (*SD* = 3.24)]. However, in both study sites, the difference did not achieve statistical significance (FIU: $p = 0.84$; UH: $p = 0.14$).

Table 4: Sociocultural factors and HPV vaccine uptake by study site

Variable	**FIU (*n* = 647) HPV Vaccine**			**UH (*n* = 123) HPV Vaccine**		
	Unvaccinated Mean (*SD*)	**Vaccinated** Mean (*SD*)	***p-value***	**Unvaccinated** Mean (*SD*)	**Vaccinated** Mean (*SD*)	***p-value***
Cancer Fatalism	10.95 (5.23)	10.10 (5.15)	**0.04**	11.58 (5.80)	10.46 (5.80)	0.29
Traditional Gender Roles	8.41 (4.00)	7.68 (3.13)	**0.01**	8.76 (4.01)	8.18 (4.16)	0.44
Familism	21.03 (4.22)	21.10 (4.13)	0.84	20.77 (3.24)	19.80 (3.89)	0.14

Note: Bold estimates indicate statistical significance at $p < 0.05$.
SD=Standard Deviation

4.5. HPV- knowledge among study participants

Table 5 shows individual items of HPV knowledge. The mean score for total knowledge of HPV among FIU participants was 8.7 (SD = 5.21) and 7.28 (SD = 5.04) among UH participants. At the item level, the analysis indicated patterns of HPV-related knowledge gaps. For example, participants' knowledge was largely incorrect about whether "HPV can cause HIV/AIDS" (FIU: 19.7%; UH: 13.9%) and whether "most sexually active people will get HPV at some point in their lives" (FIU: 19.1%; UH: 18.5%). Participants were also largely incorrect in responding to items associated with HPV-associated cancers. Even though the majority of the participants knew that HPV caused cervical cancer (FIU: 58.0%; UH 53.7%), only 25.4% of FIU participants knew that HPV could cause oral cancer, 27.5% knew that HPV could cause anal cancer, and 28.0% knew that HPV could cause penile cancer, compared to 19.4%, 19.4%, and 20.2% among UH participants, respectively.

Table 5: Number and percentage of participants correctly answering HPV-knowledge by study site

HPV-knowledge items (Correct response)	FIU	UH
	n (%)	n (%)
1. HPV is very rare (F)	357 (54.4)	55 (45.1)
2. A person infected with HPV always has visible signs or symptoms (F)	366 (55.6)	58 (47.2)
3. HPV can cause cervical cancer (T)	382 (58.0)	66 (53.7)
4. HPV can be transmitted through genital contact (T)	454 (68.2)	75 (61.5)
5. There are many types of HPV (T)	372 (56.5)	50 (41.0)
6. HPV can cause HIV/AIDS (F)	129 (19.7)	17 (13.9)
7. HPV is transmitted through sexual intercourse (T)	461 (70.2)	76 (31.8)
8. HPV can cause genital warts (T)	355 (54.2)	57 (46.3)
9. Men cannot get HPV (F)	430 (65.4)	69 (56.6)
10. Using condoms reduces the risk of getting HPV (T)	449 (68.3)	72 (58.1)
11. HPV can be cured with antibiotics (F)	211 (32.1)	34 (27.6)
12. Having multiple sexual partners increases the risk of being infected with HPV (T)	472 (71.7)	77 (62.1)
13. Most sexually active people will get HPV at some point in their lives (T)	126 (19.1)	23 (18.5)
14. A person could have HPV for years without knowing it (T)	379 (57.6)	62 (50.0)
15. Engaging in sexual activity at a young age increases one's risk of getting HPV (T)	278 (42.2)	46 (36.8)
16. HPV can cause oral cancer (T)	167 (25.4)	24 (19.4)
17. HPV can cause anal cancer (T)	181 (27.5)	24 (19.4)
18. HPV can cause penile cancer (T)	184 (28.0)	25 (20.2)

4.6. HPV- vaccine knowledge among study participants

Table 6 shows individual items related to HPV vaccine knowledge. The mean score for total HPV vaccine knowledge among FIU participants was 3.9 (*SD* = 2.78) and 3.2 (*SD* = 2.75) among UH participants. Item analysis indicated patterns of HPV-vaccine-related knowledge gaps. For example, participants were largely incorrect in answering that “the human papillomavirus (HPV) vaccine has been included in the National Immunization Schedule in the U.S.” (FIU: 3.4%; UH: 5.7%), followed by “the HPV vaccine protects against genital warts” (FIU: 19.7%; UH: 19.5%) and “the HPV vaccine is most effective if given to people who have never had sex” (FIU: 19.1%; UH: 16.3%). The item "the HPV vaccine offers protection against all sexually transmitted infections" was correctly answered by the majority of participants at both FIU (57.5%) and UH (50.8%).

Table 6: Number and percentage of participants correctly answering HPV-vaccine knowledge by study site

HPV-Vaccine knowledge items (Correct response)	FIU n (%)	UH n (%)
1. The human papillomavirus (HPV) vaccine has been included in the National Immunization Schedule in the U.S. (F)	22 (3.4)	7 (5.7)
2. For maximum protection, individuals need two or three doses of the HPV vaccine (T)	300 (46.5)	38 (30.9)
3. The HPV vaccine offers protection against all sexually transmitted infections (F)	372 (57.5)	62 (50.8)
4. Someone who has had the HPV vaccine cannot develop cancers caused by HPV (F)	224 (34.7)	35 (28.7)
5. The HPV vaccine protects against genital warts (F)	127 (19.7)	24 (19.5)
6. Girls who have had the HPV vaccine do not need Pap tests when they are older (F)	435 (67.0)	74 (60.2)
7. The HPV vaccine is most effective if given to people who have never had sex (T)	123 (19.1)	20 (16.3)
8. You can cure HPV by getting the HPV vaccine (F)	310 (48.1)	53 (43.1)
9. The HPV vaccine is approved and recommended for females aged 9-26 years (T)	335 (51.9)	45 (36.9)
10. The HPV vaccine is approved and recommended for males aged 9-26 years (T)	262 (40.7)	35 (28.7)

4.7. Unadjusted logistic regression model for HPV vaccine uptake

Table 7 shows the unadjusted odds ratio of HPV vaccine uptake by study site across the socio-demographic and cultural variables. The unadjusted logistic regression analysis found that participants at FIU who received emotional support for the HPV vaccine were twice as likely to receive the vaccine compared to those who did not have emotional support (OR: 2.15; 95% CI 1.45 – 3.16). Those who had emotional support for the HPV vaccine at the UH were three times more likely to obtain it than those who did not (OR: 3.24; 95% CI 1.34 – 7.83).

The study also found participants who had health insurance in UH were twice as likely to get the HPV vaccine compared to those who did not have health insurance (OR: 2.33; 95% CI 1.05 – 5.19). Although FIU participants with health insurance had a 29% higher chance of getting the HPV vaccine than uninsured participants, the association did not achieve statistical significance (OR: 1.29; 95% CI 0.79 – 2.09).

Table 7: Unadjusted logistic regression model for evaluating the association between sociodemographic factors and HPV vaccine uptake by study site

Variable		FIU (*n*=657) OR (95%CI)	*p values*	UH (*n*= 123) OR (95%CI)	*p values*
Age					
	21 – 26 Years	0.96 (0.70 – 1.32)	0.82	1.53 (0.75 – 3.12)	0.24
	18 – 20 Years	Ref		Ref	
Nativity					
	US – Born	0.95 (0.69 – 1.32)	0.77	1.31 (0.49 – 3.47)	0.59
	Foreign – Born	Ref		Ref	
Hispanic Origin					
	North & Central American	1.01 (0.64 – 1.61)	0.96	0.8 (0.05 – 13.13)	0.88
	South American	1.00 (0.64 – 1.56)	0.99	1.2 (0.60 – 24.47)	0.91
	Caribbean	Ref		Ref	
Employment Status					
	Employed	1.06 (0.77 – 1.46)	0.71	1.07 (0.51 – 2.29)	0.85
	Unemployed	Ref		Ref	
Health Insurance					
	Yes	1.29 (0.79 – 2.09)	0.31	**2.33 (1.05 – 5.19)**	**0.04**
	No	Ref		Ref	
Under Parent's Insurance					
	Yes	1.11 (0.81 – 1.54)	0.52	0.82 (0.40 – 1.71)	0.60
	No	Ref		Ref	
Economic Condition					
	Enough money	1.08 (0.76 – 1.53)	0.67	1.12 (0.48 – 2.61)	0.79
	Not enough money	Ref		Ref	
Emotional Support for HPV vaccine					
	Agree	**2.15 (1.45 – 3.16)**	**<0.00**	**3.24 (1.34 – 7.83)**	**0.01**
	Disagree	Ref		Ref	

Note: Bold estimates indicate statistical significance at $p < 0.05$.

4.8. Adjusted multiple logistic regression model for moderating effect of HPV Knowledge on cancer fatalism and HPV vaccine uptake controlling for covariates

The results from the multiple logistic regression analysis are presented in **Table 8** and **Table 9,** which assess the association between cancer fatalism and HPV vaccine uptake, and the moderating effect of HPV knowledge while controlling for the covariates. The moderating effect of HPV knowledge was also evaluated by estimating their interaction effect with cancer fatalism.

The study found a significant association between cancer fatalism and HPV vaccine uptake (aOR: 0.97; 95% CI: 0.92 – 0.99) without adjusting for the effect of HPV knowledge among FIU participants (**Table 8:** Model-3). While controlling for the covariates, the odds of getting the HPV vaccine were 0.97 times lower for a 1-unit increase in cancer fatalism among FIU participants. The study did not find any significant association between cancer fatalism and HPV vaccine uptake (aOR: 0.97; 95% CI: 0.88 – 1.06) without adjusting for the effect of HPV knowledge among UH participants (**Table 9:** Model -3).

The study found that higher HPV knowledge was positively associated with HPV vaccine uptake among FIU and UH participants. A 1-unit increase in HPV knowledge increased the chance of getting that HPV vaccine by 11% for FIU participants (aOR: 1.11; 95% CI: 1.07 – 1.16) and 16% for UH participants (aOR: 1.16; 95% CI: 1.03 – 1.30). However, when HPV knowledge was included in the models (**Table 8:** Model -4), it nullified the effect of cancer fatalism and vaccine uptake among FIU participants. In addition to HPV knowledge, FIU

participants who received emotional support for the HPV vaccine were twice as likely to get the vaccine as those who did not receive emotional support (aOR: 2.34; 95% CI: 1.48 – 3.73). Similarly, UH participants who received emotional support for the HPV vaccine (aOR: 3.31; 95% CI: 1.09 – 10.05), and had health insurance (aOR: 6.64; 95% CI: 1.41 – 31.28) were more likely to get the vaccine than those who did not have emotional support or health insurance. Surprisingly, the study found that participants in the UH who were covered by their parents' insurance were 82% less likely to get the HPV vaccine compared to those who were not covered by their parents' health insurance (aOR: 0.18; 95% CI: 0.04 – 0.76) while controlling for the covariates, cancer fatalism, and HPV knowledge. HPV knowledge did not moderate the association between cancer fatalism and HPV vaccine uptake (**Table 8, 9** Model -5) for both FIU (aOR: 0.99; 95% CI: 0.98 – 1.00) and UH participants (aOR: 1.01; 95% CI: 0.99 – 1.03).

4.9. Adjusted multiple logistic regression model for moderating effect of HPV vaccine knowledge on cancer fatalism and HPV vaccine uptake controlling for covariates

The results from the multiple logistic regression analysis are presented in **Table 10** and **Table 11** to assess the association between cancer fatalism and HPV vaccine uptake, and the moderating effect of HPV vaccine knowledge while controlling for the other covariates. The moderating effect of HPV vaccine knowledge was also evaluated by estimating its interaction effect with cancer fatalism.

The study found a significant association between cancer fatalism and HPV vaccine uptake (aOR: 0.97; 95% CI: 0.92 – 0.99) without adjusting for the effect of HPV vaccine knowledge among FIU participants (**Table 10:** Model -3). The odds of getting the HPV vaccine were 0.97 times lower for a 1-unit increase in cancer fatalism among FIU participants while controlling for the covariates. The study did not find any significant association between cancer fatalism and HPV vaccine uptake (aOR: 0.97; 95% CI: 0.88 – 1.06) without adjusting for the effect of HPV knowledge among UH participants (**Table 11:** Model -3).

The study found that higher HPV vaccine knowledge was positively associated with HPV vaccine uptake among FIU and UH participants. Like HPV knowledge, a 1-unit increase in HPV vaccine knowledge increases the chance of getting the HPV vaccine by 43% for FIU participants (aOR: 1.43; 95% CI: 1.32 – 1.56) and 42% for UH participants (aOR: 1.42; 95% CI: 1.16 – 1.73). However, when HPV vaccine knowledge was included in the models (**Table 10** and **Table**

11; Model -4)**,** the study did not find any significant association between cancer fatalism and HPV vaccine uptake for both FIU (aOR: 0.99; 95% CI: 0.95 – 1.03) and UH participants (aOR: 0.98; 95% CI: 0.89 - 1.07). In addition to HPV vaccine knowledge, FIU participants who received emotional support for the HPV vaccine were twice as likely as those who did not receive emotional support (aOR: 2.04; 95% CI: 1.24 – 3.37). Similarly, UH participants who received emotional support for the HPV vaccine (aOR: 3.61; 95% CI: 1.13 – 11.51) and had health insurance (aOR: 9.38; 95% CI: 1.91 – 46.11) were more likely to receive the vaccine than those who did not receive emotional support or had no health insurance. Surprisingly, the study found that participants in the UH who were covered by their parents' insurance were 84% less likely to get the HPV vaccine compared to those who were not covered by their parents' health insurance (aOR: 0.16; 95% CI: 0.04 – 0.71) while controlling for the potential covariates, cancer fatalism, and HPV vaccine knowledge.

HPV vaccine knowledge did not moderate the association between cancer fatalism and HPV vaccine uptake (**Table 10, 11** Model -5). The interaction effect between cancer fatalism and HPV vaccine knowledge was found to be non-significant for both FIU (aOR: 1.00; 95% CI: 0.98–1.02) and UH participants (aOR: 1.01; 95% CI: 0.98–1.05) participants.

Table 8: Adjusted multiple logistic regression model for moderating effect of HPV Knowledge on cancer fatalism and HPV vaccine uptake controlling for covariates in FIU

Predictors	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Block 1	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
Age	0.84 (0.57 - 1.23)	0.82 (0.55 - 1.22)	0.83 (0.56 - 1.23)	0.73 (0.48 - 1.10)	0.73 (0.48 - 1.10)
Nativity	0.80 (0.54 - 1.19)	0.79 (0.53 - 1.18)	0.76 (0.51 - 1.15)	0.70 (0.46 - 1.07)	0.69 (0.45 - 1.05)
Caribbean	1	1	1	1	1
South American	1.20 (0.72 - 2.00)	1.20 (0.72 - 2.00)	1.17 (0.70 - 1.96)	1.13 (0.67 - 1.92)	1.16 (0.68 - 1.98)
North & Central	1.09 (0.64 - 1.86)	1.11 (0.65 - 1.89)	1.13 (0.66 - 1.93)	1.07 (0.61 - 1.87)	1.05 (0.60 - 1.84)
Employment	1.25 (0.84 - 1.84)	1.23 (0.83 - 1.83)	1.22 (0.82 - 1.81)	1.25 (0.83 - 1.88)	1.25 (0.83 - 1.89)
Financial Stability	1.20 (0.80 - 1.81)	1.19 (0.79 - 1.81)	1.21 (0.80 - 1.83)	1.23 (0.80 - 1.89)	1.25 (0.81 - 1.92)
Emotional Support	**2.59 (1.66 - 4.03)**	**2.61 (1.67 - 4.07)**	**2.56 (1.64 - 4.00)**	**2.34 (1.48 - 3.73)**	2.34 (1.47 - 3.71)
Block 2					
Health Insurance		1.26 (0.67 - 2.38)	1.30 (0.69 - 2.44)	1.16 (0.61 - 2.22)	1.15 (0.60 - 2.21)
Under parents' Insurance		0.90 (0.58 - 1.41)	0.90 (0.57 - 1.40)	0.93 (0.59 - 1.48)	0.92 (0.58 - 1.46)
Block 3					
Cancer Fatalism			**0.96 (0.92 - 0.99)**	0.97 (0.94 - 1.01)	0.98 (0.94 - 1.01)
Block 4					
HPV Knowledge				**1.11 (1.07 - 1.16)**	1.11 (1.07 - 1.16)
Block 5					
Cancer Fatalism*HPV Knowledge					0.99 (0.98 - 1.00)

Cancer fatalism and HPV knowledge was mean-centered in Block 5

Table 9: Adjusted multiple logistic regression model for moderating effect of HPV Knowledge on cancer fatalism and HPV vaccine uptake controlling for covariates in UH

Predictors	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Block 1	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**
Age	2.03 (0.85 - 4.85)	1.86 (0.74 - 4.67)	2.25 (0.85 - 5.98)	2.63 (0.96 - 7.25)	2.74 (0.98 - 7.63)
Nativity	0.72 (0.22 - 2.34)	0.58 (0.16 - 2.03)	0.54 (0.15 - 1.95)	0.42 (0.10 - 1.68)	0.49 (0.12 - 2.06)
Employment	0.68 (0.26 - 1.74)	0.54 (0.19 - 1.49)	0.59 (0.21 - 1.67)	0.64 (0.23 - 1.81)	0.65 (0.23 - 1.83)
Financial Stability	0.86 (0.32 - 2.36)	0.79 (0.28 - 2.24)	0.86 (0.30 - 2.46)	0.93 (0.31 - 2.82)	0.97 (0.32 - 2.94)
Emotional Support	**3.55 (1.35 - 9.33)**	**3.87 (1.36 - 10.99)**	**3.85 (1.34 - 11.06)**	**3.31 (1.09 - 10.05)**	3.38 (1.10 - 10.33)
Block 2					
Health Insurance		**7.93 (1.88 - 33.39)**	**7.69 (1.79 - 32.96)**	**6.64 (1.41 - 31.28)**	6.78 (1.43 - 32.14)
Under parents' Insurance		**0.20 (0.05 - 0.76)**	**0.20 (0.05 - 0.79)**	**0.18 (0.04 - 0.76)**	0.20 (0.05 - 0.85)
Block 3					
Cancer Fatalism			0.94 (0.86 - 1.02)	0.97 (0.88 - 1.06)	0.97 (0.89 - 1.06)
Block 4					
HPV Knowledge				**1.16 (1.03 - 1.30)**	1.16 (1.03 - 1.30)
Block 5					
Cancer Fatalism*HPV Knowledge					1.01 (0.99 - 1.03)

*Removed nativity from the model due to low cell count (*n*=2)
Cancer fatalism and HPV knowledge was mean-centered in Model 5

Table 10: Adjusted multiple logistic regression model for moderating effect of HPV Vaccine Knowledge on cancer fatalism and HPV vaccine uptake controlling for covariates in FIU

Predictors	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Block 1	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**
Age	0.82 (0.55 - 1.21)	0.81 (0.54 - 1.20)	0.81 (0.55 - 1.21)	0.72 (0.46 - 1.11)	0.72 (0.46 - 1.11)
Nativity	0.80 (0.54 - 1.19)	0.79 (0.53 - 1.18)	0.76 (0.51 - 1.14)	0.86 (0.55 - 1.35)	0.86 (0.54 - 1.35)
Caribbean	1	1	1	1	1
South American	1.23 (0.74 - 2.04)	1.22 (0.73 - 2.04)	1.20 (0.71 - 2.00)	0.97 (0.55 - 1.72)	0.97 (0.55 - 1.72)
North & Central	1.11 (0.65 - 1.89)	1.12 (0.66 - 1.92)	1.15 (0.67 - 1.96)	1.17 (0.64 - 2.12)	1.17 (0.64 - 2.12)
Employment	1.26 (0.85 - 1.87)	1.25 (0.84 - 1.86)	1.23 (0.83 - 1.84)	1.40 (0.90 - 2.18)	1.40 (0.90 - 2.18)
Financial Stability	1.21 (0.80 - 1.82)	1.20 (0.79 - 1.82)	1.21 (0.80 - 1.84)	1.16 (0.73 - 1.84)	1.16 (0.73 - 1.84)
Emotional Support	2.64 (1.69 - 4.13)	2.66 (1.70 - 4.16)	2.62 (1.67 - 4.10)	**2.04 (1.24 - 3.37)**	2.05 (1.24 - 3.37)
Block 2					
Health Insurance		1.25 (0.66 - 2.35)	1.28 (0.68 - 2.42)	1.27 (0.63 - 2.55)	1.27 (0.63 - 2.55)
Under parents' Insurance		0.91 (0.58 - 1.42)	0.90 (0.57 - 1.41)	1.14 (0.70 - 1.87)	1.14 (0.70 - 1.87)
Block 3					
Cancer Fatalism			0.96 (0.92 - 0.99)	0.99 (0.95 - 1.03)	0.99 (0.95 - 1.03)
Block 4					
HPV Vaccine Knowledge				**1.43 (1.32 - 1.56)**	1.43 (1.32 - 1.56)
Block 5					
Cancer Fatalism*HPV Vaccine Knowledge					1.00 (0.98 - 1.02)

Cancer fatalism and HPV vaccine knowledge was mean-centered in Model 5

Table 11: Adjusted multiple logistic regression model for moderating effect of HPV Vaccine Knowledge on cancer fatalism and HPV vaccine uptake controlling for covariates in UH

Predictors	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Block 1	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**
Age	2.03 (0.85 - 4.85)	1.86 (0.74 - 4.67)	2.25 (0.85 - 5.98)	1.99 (0.70 - 5.68)	2.04 (0.71 - 5.86)
Nativity	0.72 (0.22 - 2.34)	0.58 (0.16 - 2.03)	0.54 (0.15 - 1.95)	0.33 (0.08 - 1.42)	0.36 (0.08 - 1.65)
Employment	0.68 (0.26 - 1.74)	0.54 (0.19 - 1.49)	0.59 (0.21 - 1.67)	0.49 (0.16 - 1.50)	0.50 (0.17 - 1.53)
Financial Stability	0.86 (0.32 - 2.36)	0.79 (0.28 - 2.24)	0.86 (0.30 - 2.46)	0.99 (0.31 - 3.15)	1.04 (0.32 - 3.34)
Emotional Support	3.55 (1.35 - 9.33)	3.87 (1.36 - 10.99)	3.85 (1.34 - 11.06)	**3.61 (1.13 - 11.51)**	3.56 (1.11 - 11.37)
Block 2					
Health Insurance		7.93 (1.88 - 33.39)	7.69 (1.79 - 32.96)	**9.38 (1.91 - 46.11)**	10.11 (2.00 - 51.18)
Under parents' Insurance		0.20 (0.05 - 0.76)	0.20 (0.05 - 0.79)	**0.16 (0.04 - 0.71)**	0.17 (0.04 - 0.74)
Block 3					
Cancer Fatalism			0.94 (0.86 - 1.02)	0.98 (0.89 - 1.07)	0.98 (0.89 - 1.08)
Block 4					
HPV Vaccine Knowledge				**1.42 (1.16 - 1.73)**	1.41 (1.16 - 1.72)
Block 5					
Cancer Fatalism*HPV Vaccine Knowledge					1.01 (0.98 - 1.05)

*Removed nativity from the model due to low cell count (*n*=2)
Cancer fatalism and HPV vaccine knowledge was mean-centered in Model 5

4.10. Adjusted multiple logistic regression model for moderating effect of acculturation on traditional gender roles and HPV vaccine uptake controlling for covariates

The results from the multiple logistic regression analysis were presented in **Table 12** and **Table 13** to assess the moderating effect of acculturation on traditional gender roles and HPV vaccine uptake.

The study found a significant association between traditional gender roles and HPV vaccine uptake (aOR: 0.94; 95% CI 0.89 – 0.99) without adjusting for the effect of acculturation among FIU participants (**Table 12** Model-3). The odds of getting the HPV vaccine were 0.94 times lower for a 1-unit increase in traditional gender roles, among FIU participants while controlling for potential covariates. Unlike FIU, the study did not find any significant association between traditional gender roles and HPV vaccine uptake (aOR: 0.96; 95% CI 0.84 – 1.09) without adjusting for the effect of acculturation among UH participants (**Table 13** Model-3).

The study found that higher acculturation was positively associated with HPV vaccine uptake among UH participants but not among FIU participants (**Table 12, 13,** Model-4). A 1-unit increase in acculturation increased the chance of getting the HPV vaccine by 87% for UH participants (aOR: 1.87; 95% CI 1.15 – 3.04). Although, among FIU participants, acculturation was not significant, emotional support for the HPV vaccine was significantly associated with the HPV vaccine uptake. Participants in FIU who had emotional support were twice as likely to get the vaccine (aOR: 2.50; 95% CI: 1.59 – 3.93) compared to those who did not have emotional support for the

HPV vaccine. Participants at UH who had health insurance (aOR: 15.75; 95% CI: 3.12 – 79.51) were fifteen times more likely to receive the vaccine than those who did not. Interestingly, the study did not find any significant association between emotional support and HPV vaccine uptake among UH participants for this model. Surprisingly, the study found that participants in the UH who were covered by their parents' insurance were 88% less likely to get the HPV vaccine compared to those who were not covered by their parent's health insurance (aOR: 0.12; 95% CI 0.03 – 0.51) after controlling for the potential covariates; traditional gender roles, and acculturation.

Acculturation did not moderate the relationship between traditional gender roles and HPV vaccine uptake as the interaction effect (**Table 12, 13** Model-5) between traditional gender roles and acculturation was not statistically significant for both FIU (aOR: 1.01; 95% CI: 0.96 – 1.07) and UH participants (aOR: 1.11; 95% CI: 0.94 – 1.32).

Table 12: Adjusted multiple logistic regression model for moderating effect of acculturation on traditional gender roles and HPV vaccine uptake controlling for covariates in FIU

Predictors	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Block 1	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**
Age	0.81 (0.55 - 1.21)	0.81 (0.54 - 1.20)	0.82 (0.55 - 1.22)	0.83 (0.56 - 1.24)	0.84 (0.56 - 1.25)
Nativity	0.80 (0.53 - 1.19)	0.79 (0.53 - 1.19)	0.77 (0.51 - 1.16)	0.87 (0.56 - 1.37)	0.87 (0.56 - 1.37)
Caribbean	1	1	1	1	1
South American	1.13 (0.68 - 1.87)	1.12 (0.67 - 1.86)	1.11 (0.67 - 1.86)	1.11 (0.67 - 1.86)	1.11 (0.66 - 1.85)
North & Central	1.08 (0.63 - 1.83)	1.09 (0.64 - 1.86)	1.10 (0.64 - 1.87)	1.10 (0.64 - 1.87)	1.09 (0.64 - 1.86)
Employment	1.29 (0.87 - 1.91)	1.28 (0.86 - 1.91)	1.28 (0.86 - 1.91)	1.27 (0.85 - 1.90)	1.27 (0.85 - 1.90)
Financial Stability	1.12 (0.74 - 1.69)	1.11 (0.73 - 1.68)	1.12 (0.74 - 1.71)	1.12 (0.74 - 1.70)	1.11 (0.73 - 1.70)
Emotional Support	2.49 (1.60 - 3.89)	2.51 (1.61 - 3.92)	2.42 (1.54 - 3.79)	**2.50 (1.59 - 3.93)**	2.48 (1.58 - 3.91)
Block 2					
Health Insurance		1.23 (0.65 - 2.32)	1.21 (0.64 - 2.28)	1.25 (0.66 - 2.38)	1.25 (0.66 - 2.38)
Under parents' Insurance		0.94 (0.60 - 1.48)	0.95 (0.61 - 1.50)	0.93 (0.59 - 1.46)	0.93 (0.59 - 1.46)
Block 3					
Traditional Gender Roles			0.94 (0.89 – 0.99)	0.94 (0.89 - 1.00)	0.94 (0.89 - 1.00)
Block 4					
Acculturation				1.13 (0.94 - 1.36)	1.14 (0.94 - 1.37)
Block 5					
Acculturation*Gender Roles					1.01 (0.96 - 1.07)

Traditional gender roles and acculturation was mean-centered in Model 5

Table 13: Adjusted multiple logistic regression model for moderating effect of acculturation on traditional gender roles and HPV vaccine uptake controlling for covariates in UH

Predictors	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Block 1	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**
Age	2.03 (0.85 - 4.85)	1.86 (0.74 - 4.67)	1.89 (0.75 - 4.77)	1.73 (0.66 - 4.53)	1.87 (0.71 - 4.96)
Nativity	0.72 (0.22 - 2.34)	0.58 (0.16 - 2.03)	0.55 (0.15 - 1.94)	0.63 (0.18 - 2.24)	0.70 (0.19 - 2.51)
Employment	0.68 (0.26 - 1.74)	0.54 (0.19 - 1.49)	0.56 (0.20 - 1.56)	0.46 (0.16 - 1.36)	0.45 (0.15 - 1.32)
Financial Stability	0.86 (0.32 - 2.36)	0.79 (0.28 - 2.24)	0.83 (0.29 - 2.38)	0.84 (0.29 - 2.49)	0.83 (0.28 - 2.44)
Emotional Support	3.55 (1.35 - 9.33)	3.87 (1.36 - 10.99)	3.60 (1.25 - 10.42)	2.72 (0.89 - 8.27)	2.91 (0.94 - 9.03)
Block 2					
Health Insurance		7.93 (1.88 - 33.39)	7.89 (1.88 - 33.15)	**15.75 (3.12 - 79.51)**	16.80 (3.29 - 85.76)
Under parents' Insurance		0.20 (0.05 - 0.76)	0.21 (0.06 - 0.79)	**0.12 (0.03 - 0.51)**	0.11 (0.03 - 0.50)
Block 3					
Traditional Gender Roles			**0.96 (0.84 - 1.09)**	0.97 (0.84 - 1.12)	0.99 (0.86 - 1.15)
Block 4					
Acculturation				**1.87 (1.15 - 3.04)**	1.97 (1.18 - 3.29)
Block 5					
Acculturation*Gender Role					1.11 (0.94 - 1.32)

*Removed from the model due to low cell count (*n*=2)
Traditional gender roles and acculturation was mean-centered in Model 5

4.11. Adjusted multiple logistic regression model for measuring the association between familism and HPV vaccine uptake controlling for covariates

The study did not find any significant association between familism and HPV vaccine uptake among FIU (aOR: 0.98; 95% CI: 0.94 – 1.03) or UH participants (aOR: 0.87; 95% CI: 0.76 – 1.01) (**Table 14. 15** Model -3). Although, among FIU participants, familism was not significant, emotional support for the HPV vaccine was significantly associated with HPV vaccine uptake. Participants in FIU who had emotional support were twice as likely to get the vaccine (aOR: 2.75; 95% CI: 1.76 – 4.30) compared to those who did not have emotional support for the HPV vaccine. Among UH participants, those who received emotional support for the HPV vaccine (aOR: 3.95; 95% CI: 1.36 – 11.46), and had health insurance (aOR: 11.03; 95% CI: 2.35 – 51.74) were more likely to get the vaccine than those who did not have emotional support or health insurance. Similar to the other models, the study found that participants in UH who were covered by their parents' insurance were 81% less likely to get the HPV vaccine compared to those who were not covered by their parent's health insurance (aOR: 0.19; 95% CI: 0.05 – 0.76) after controlling for the potential covariates and familism.

Table 14: Adjusted multiple logistic regression model for familism and HPV vaccine uptake controlling for covariates stratified in FIU

Predictors	**Model 1**	**Model 2**	**Model 3**
Block 1	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**
Age	0.80 (0.54 - 1.19)	0.80 (0.54 - 1.18)	0.80 (0.54 - 1.19)
Nativity	0.79 (0.53 - 1.18)	0.79 (0.53 - 1.18)	0.80 (0.53 - 1.20)
Caribbean	1	1	1
South American	1.22 (0.73 - 2.02)	1.21 (0.73 - 2.00)	1.21 (0.73 - 2.01)
North & Central	1.19 (0.70 - 2.04)	1.21 (0.71 - 2.07)	1.21 (0.70 - 2.07)
Employment	1.23 (0.83 - 1.82)	1.23 (0.82 - 1.83)	1.23 (0.83 - 1.83)
Financial stability	1.18 (0.78 - 1.77)	1.16 (0.77 - 1.76)	1.20 (0.79 - 1.82)
Emotional Support	2.68 (1.72 - 4.18)	2.70 (1.73 - 4.21)	**2.75 (1.76 - 4.30)**
Block 2			
Health Insurance		1.25 (0.66 - 2.34)	1.24 (0.66 - 2.33)
Under parents' Insurance		0.95 (0.61 - 1.49)	0.96 (0.62 - 1.51)
Block 3			
Familism			0.98 (0.94 - 1.03)

Table 15: Adjusted multiple logistic regression model for familism and HPV vaccine uptake controlling for covariates stratified in UH

Predictors	**Model1**	**Model 2**	**Model 3**
Block 1	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**
Age	2.03 (0.85 - 4.85)	1.86 (0.74 - 4.67)	2.22 (0.85 - 5.84)
Nativity	0.72 (0.22 - 2.34)	0.58 (0.16 - 2.03)	0.59 (0.17 - 2.09)
Employment	0.68 (0.26 - 1.74)	0.54 (0.19 - 1.49)	0.51 (0.18 - 1.45)
Financial stability	0.86 (0.32 - 2.36)	0.79 (0.28 - 2.24)	0.83 (0.29 - 2.38)
Emotional Support	3.55 (1.35 - 9.33)	3.87 (1.36 - 10.99)	**3.95 (1.36 - 11.46)**
Block 2			
Health Insurance		7.93 (1.88 - 33.39)	**11.03 (2.35 - 51.74)**
Under parents' Insurance		0.20 (0.05 - 0.76)	0.19 (0.05 - 0.76)
Block 3			
Familism			0.87 (0.76 - 1.01)

*Removed from the model due to low cell count (*n*=2)

CHAPTER 5: DISCUSSION

The purpose of this study was to examine the association between sociocultural factors (e.g., cancer fatalism, traditional gender roles, and familism) and HPV vaccine uptake. This is the first study to examine this association among female Hispanic emerging adults. Results from this study indicate some differences between the two study sites (i.e., Miami and Houston) in the sociocultural factors, which are discussed in detail below.

A total of 56% of FIU participants received at least one dose of the HPV vaccine, compared to 45% of UH participants. The rates of HPV vaccine uptake in this study were consistent with the national HPV completion rate of 48.8% among female Hispanic emerging adults (Boersma & Black, 2020). One possible explanation for the overall low vaccine uptake could be health care providers' missed opportunities to offer the vaccine. A missed opportunity is defined as an instance where an eligible individual does not receive the vaccine despite being in contact with a healthcare provider (United Nations Children's Fund, 2019). Previous research has found that missed opportunities to recommend the vaccine is one of the leading causes of low HPV vaccine uptake in the U.S., including among emerging adults (Oliveira et al., 2018). Another possible explanation for low vaccine uptake could be that medical professionals are unaware that they can offer the vaccine to emerging adults, as the vaccine is generally administered to adolescents between the ages of 11 and 13. Healthcare personnel are the most significant and trusted source of information

regarding HPV and HPV vaccination (Mohammed et al., 2016). As a result, healthcare providers on university campuses should take advantage of any opportunity to educate emerging adults about HPV-associated cancers and encourage them to get vaccinated. The American Society of Clinical Oncology and the American Cancer Society issued a joint statement on cancer prevention with HPV vaccination, reinforcing the urge for increased HPV vaccine uptake across the country (Bailey et al., 2016; Saslow et al., 2016). Implementing standing orders in clinics may help reduce missed opportunities and increase vaccination rates in this population.

The findings of this study suggest that, in addition to sociodemographic variables, Hispanic cultural factors may influence vaccine uptake. The study hypothesized that higher cancer fatalism would be associated with lower vaccine uptake. Additionally, this study hypothesized that the relationship between cancer fatalism and HPV vaccine uptake would be stronger for Hispanics with lower HPV knowledge and lower HPV vaccine knowledge. Aim 1 of this study found a significant association between cancer fatalism and HPV vaccine uptake among FIU participants but not among UH participants. The non-significant finding among UH participants could be due to the smaller sample size or to differences in the Hispanic population at UH. Additional studies are needed to further investigate these differential findings.

The odds of getting the vaccine are 0.97 times lower for each 1-unit increase in cancer fatalism among FIU participants. Among some Hispanics, cancer is considered “bad luck” (Downs Jr et al., 2010) and fatalism may become

a cultural obstacle (Perez-Stable et al., 1992a). Cancer fatalism was found to be a potential barrier in cancer screening (e.g., colorectal cancer, breast cancer) even after controlling for the potential covariates (Bakan et al., 2021; Cohen et al., 2021). However, the association between cancer fatalism and HPV vaccine uptake has never been investigated in this population. A potential explanation for lower vaccine uptake could be due to some Hispanics holding fatalistic beliefs that cancer outcomes are beyond human control and that an individual's fate is predetermined by God (Cleveland & Horner, 2012; Madhivanan et al., 2016).

Fatalism has already been identified as a barrier to health-seeking behavior and health outcomes (Powe & Finnie, 2003). The challenge regarding fatalism is that it is a cognitive belief that influences an individual to act on behavioral intention but is dependent on how the individual perceives the outcome. Individuals with higher levels of fatalism were found to be more likely to engage in healthy preventative behavior, but less likely to adapt when the outcome might be terminal (Shen et al., 2009). Because of cancer fatalism, some Hispanics may perceive fewer benefits from the HPV vaccine, despite the positive health impact and its availability and accessibility to them in the U.S. The findings of this study suggest the necessity for public health practitioners to design culturally-tailored health promotion programs that effectively reduce levels of fatalistic beliefs. In addition to that, another way to reduce cancer fatalism among emerging adults is to educate them on HPV and the benefits of the vaccine. Increased knowledge will reduce beliefs about HPV-related cancers, which in turn will reduce cancer fatalism among participants.

This study's results indicate that knowledge regarding HPV and the HPV vaccine is associated with vaccine uptake among FIU and UH participants. Previous research has demonstrated that higher HPV knowledge (Kellogg et al., 2019; Thompson et al., 2016) and higher HPV vaccine knowledge (Kasymova et al., 2019; Natipagon-Shah et al., 2021) is associated with higher HPV vaccine uptake, including among college students. In contrast, some researchers have not found any association between HPV knowledge and vaccine uptake (Ratanasiripong, 2015; Ratanasiripong et al., 2013). This study also found that participants had moderate knowledge of HPV, which is consistent with previous research (Karki et al., 2020; Kasymova et al., 2019; Natipagon-Shah et al., 2021). Despite the study participants' overall knowledge of HPV, this study was able to investigate item-level knowledge gaps, which is especially important given that HPV can cause various cancers (e.g., oral, anal, penile). This study found that emerging adults are not well aware of the HPV vaccine, which is similar to previous research findings (Kellogg et al., 2019; Ragan et al., 2018). The results of this study are similar to those of Ragan et al., who found that most college students are unaware of the vaccine's availability through student health clinics (Ragan et al., 2018). This study suggests that while HPV infection is mostly known for causing cervical cancer, programs aimed at emerging adults are needed to provide comprehensive awareness about HPV, both among male and female emerging adults. Itemized HPV information would aid in the development of programs for health care personnel to provide focused and efficient education to emerging adults. In addition to that, the acceptability and

eligibility of the HPV vaccine needs to be publicized across college campuses in order to increase emerging adults' knowledge regarding HPV and the HPV vaccine. This could be accomplished by recruiting students and training them as lay health workers to disseminate this information.

Finally, Aim 1 of this study did not find any moderating effect of HPV knowledge or HPV vaccine knowledge on the association between cancer fatalism and HPV vaccine uptake. Among FIU participants, the association between cancer fatalism and HPV vaccine uptake was nullified after HPV knowledge and HPV vaccine knowledge were included in two separate models. This phenomenon suggests that HPV knowledge and HPV vaccine knowledge may have a mediating effect on the causal pathway between cancer fatalism and HPV vaccine uptake. Future research should further investigate this association.

Aim 2 of this study hypothesized that higher levels of traditional gender roles would be associated with lower HPV vaccine uptake. Additionally, Aim 2 also hypothesized that the relationship between traditional gender roles and HPV vaccine uptake would be stronger among Hispanics with lower acculturation. Findings indicate that the odds of getting the HPV vaccine were 0.94 times lower for a 1-unit increase in traditional gender roles among FIU participants, but not UH participants. As with fatalism, the non-significant finding among UH participants could be due to the smaller sample size or to differences in the Hispanic population at UH. Additional studies are needed to determine if the nature of these differences.

Empirical studies have suggested that some Hispanic men have stronger gender role expectations (Archer, 1992), hold overall sexist beliefs (Parrott et al., 2002), and have a higher level of adherence to traditional gender norms compared to Hispanic women (Kerns & Fine, 1994). Some men may expect women to remain virgins until they get married, actively pursue marriage, have children (O'Sullivan & Meyer-Bahlburg, 2003), and be submissive to the man (Zinn, 1982). Cultural norms, strict gender role enforcement, and (promiscuous when having premarital sex) the belief that women should be monogamous are designed by men (Fullilove et al., 1990). Previous research has shown a direct association between different gender roles and health behaviors. For example, women may engage in more anal sex to keep their virginity as part of Hispanic cultural demand (Wingood & DiClemente, 2000). In addition, because of gender role expectations, some Hispanic women may find it difficult to negotiate protective sexual practices (Cianelli et al., 2008; Seal et al., 2012) and can be accused of infidelity when they ask sexual partners to use a condom (Centers for Disease Control and Prevention, 1999). Previous research found that Hispanic women are more hesitant and shameful about discussing sex and condom use with their families compared to males (Schiffner & Buki, 2006). Traditional gender roles can be a critical component in the decision making process to receive the HPV vaccine, as college students might feel the pressure of being in college, and may have a stereotyped gender ideology. It is possible that HPV vaccination does not require the same conversation or negotiation as condom use or certain sexual practices. Therefore, Hispanic females may be able to decide to be

vaccinated without navigating the complexities of traditional gender roles. Future research should examine the association between traditional gender roles and HPV vaccine uptake thoroughly.

Additionally, this research found that higher acculturation was associated with higher HPV vaccine uptake among UH participants, but not with FIU participants. Extensive research has shown that acculturation is associated with a variety of health behaviors (e.g., substance use, eating behavior, and use of health care services) and outcomes (e.g., obesity, low birthweight) (Abraído-Lanza et al., 2016; Delavari et al., 2013; Lara et al., 2005; Park et al., 2009). However, the site difference in the association between acculturation and vaccine uptake in this study could be explained in part by the parents' exposure to a robust immunization program in their country of origin. For instance, the majority of participants at UH are of Mexican descent. Since 1980, Mexico has been one of the few countries to successfully execute comprehensive childhood immunization programs, including HPV vaccination (Frenk et al., 2003).

Previous research among parents was performed to examine the association between acculturation and parents' health beliefs about the HPV vaccine (Gerend et al., 2021). However, no research has been conducted to investigate the association between acculturation and HPV vaccine uptake among emerging adults. As a result, the current study adds to the literature by underlining the need to assess acculturation independently. In this study, acculturation did not moderate the association between traditional gender roles and HPV vaccination uptake; rather, it nullified the impact of traditional gender

roles on HPV vaccine uptake among FIU participants. These data suggest that acculturation may have a mediating role in the relationship. More research is needed to identify the moderating factors in the association between acculturation and HPV vaccine uptake. A target-based intervention for emerging adults with higher acculturation would be beneficial while also helping to increase overall vaccination rates.

Aim 3 of this study hypothesized that higher levels of familism would be associated with higher HPV vaccine uptake. The study found no significant association between familism and HPV vaccination uptake among study participants, which contradicts previous research findings. HPV vaccine decision-making is heavily impacted by family. Previous research among college students in the U.S. found that parents made decisions about whether or not their children would receive the HPV vaccine regardless of their age. However, when it came to receiving the flu vaccine, the students demonstrated more independent decision-making abilities (Ragan et al., 2018). Furthermore, research has shown that college students who believed their family would oppose HPV vaccination were less likely to receive the vaccine than those who believed their family would support the vaccination (Goldfarb & Comber, 2020). Prior studies indicate that many Hispanics are raised to be loyal to the family (Sabogal et al., 1987) and some Hispanic women may encounter restrictions on female autonomy (Bámaca-Colbert et al., 2012). Hispanics, in general, have a strong connection with their families. Previous research has found that a high level of family support is positively associated with providing support during a time of crisis and

psychological distress (Umaña-Taylor et al., 2011). According to a study conducted among college students aged 18 to 26, those who received the HPV vaccine believed the vaccine was safe and widely accepted in society (Marchand et al., 2012).

The results of this study indicate that it is probable that HPV vaccination does not always necessitate discussion or negotiation with family members. Hispanic emerging adults would likely be able to decide to be vaccinated without having to navigate the ramification of familism and beyond their family values. More research is needed to determine how familism influences the HPV vaccine decision-making process.

In addition to the Hispanic cultural factors, some sociodemographic factors were found to be significantly associated with HPV vaccine uptake in this study. These include the following: having health insurance, being under their parents' insurance, and having emotional support for the HPV vaccine. In this study, health insurance status was measured using two similar, yet distinct, variables: whether or not participants had health insurance and if they were under their parents' insurance. Even though the broader purpose of these two variables was to capture the insurance status of the participants, they also explain two different circumstances. According to this study, 87.9% of participants at FIU and 65.3% at UH had health insurance. Across all four adjusted models, participants with health insurance in UH were more likely to receive the vaccine than those without insurance; however, no difference was observed among FIU participants. These findings are consistent with previous studies which indicate having health

insurance is significantly associated with higher vaccine uptake (Cofie et al., 2018; Schmidt & Parsons, 2014). Previous research has also indicated that people with health insurance are more likely to obtain preventive services, including vaccinations (Anandappa et al., 2018; Lu et al., 2014).

Furthermore, researchers have found that health insurance reforms were significantly associated with increased HPV vaccine uptake (Hawkins et al., 2021). The Patient Protection and Affordable Care Act (ACA) of 2010 eliminated the financial barriers to receiving the HPV vaccine (Holman et al., 2014; Newman et al., 2018; Rambout et al., 2014) by ensuring non-grandfathered private insurance cover the HPV vaccine with no patient cost-sharing (US Government, 2010). Since 2014, individuals 19 years and older who are eligible for Medicaid have also been able to receive the HPV vaccine due to the ACA Medicaid expansion. Vaccine for Children (VFC) allows individuals to get the recommended vaccines by the CDC's Advisory Community for Immunization Practices (ACIP) at no cost, regardless of their health insurance status (Kaiser Family Foundation, 2021). In addition to VFC, the Children's Health Insurance Program (CHIP) has expanded its coverage to include individuals who have previously been ineligible for the vaccine (Kaiser Family Foundation, 2021). Furthermore, the dependent care provision allows an individual to remain on their parent's insurance until the age of 26.

Despite the fact that health insurance positively impacts vaccine uptake and the vaccine is offered through multiple federal programs, poor vaccine uptake indicates underlying system gaps. For example, if a person does not have

health insurance, he or she can get the vaccine from any physician, but the clinic must be part of the Adult Safety Net (ASN) program. The difficulty in some circumstances is that the healthcare provider may be a VFC provider, but not an ASN provider while even being a Federally Qualified Health Care Center (FQHC). As a result of this convoluted structure, emerging adults without insurance and whose physician is not an ASN member must pay out of pocket to get the vaccine, creating a substantial barrier to vaccine uptake.

Finally, the immunization information system (IIS) and data sharing from state to state could be another potential barrier (Fuller et al., 2017) for HPV vaccine uptake. ImmTrac2 is used in Texas to keep vaccination data for children, while Florida SHOTS is used in Florida (Florida SHOTS; Texas Human and Health Services, 2020). ImmTrac2 retains vaccination records for children up to the age of 17, but beyond that it is optional, and the system deletes immunization records if individuals do not provide consent (Texas Human and Health Services, 2020). Under these conditions, healthcare practitioners find it difficult to monitor vaccination records and provide the HPV vaccine to emerging adults. Furthermore, there is no method for healthcare practitioners to obtain a new patient's vaccination status when they arrive from out of state.

Although previous studies showed that being covered by a parent's health insurance increases vaccination uptake, this may not be the case with the HPV vaccine. Of the 770 participants in this research who did not receive the HPV vaccine, 61% of them in FIU and 55 % of them in UH were covered by their parents' insurance. Research has found that though peer pressure has a

significant influence on the decision-making process, college women prefer to discuss vaccination with their parents (Allen et al., 2009). However, they might not want to tell their parents that they have received or would like to receive the HPV vaccine, since it may indicate promiscuity or an early sexual debut. If an emerging adult is covered by their parent's insurance and receives the vaccination, their parents might be notified by the insurance company. Therefore, some emerging adults may avoid HPV vaccination in order to avoid talking to their parents about the HPV vaccine if they happen to get a notification. A previous study found that 20% of parents believed that getting the HPV vaccine would encourage risky sexual behavior (Rutten et al., 2017). In addition to that, HPV vaccine decision-making among emerging adults could be primarily molded by the injunctive norms of their parents (Hopfer & Clippard, 2011). Future studies are needed to examine whether or not parental beliefs influence HPV vaccine uptake among emerging adults.

Emotional support for the HPV vaccine was found to be significantly associated with HPV vaccine uptake. This research has identified that having emotional support positively influences emerging adults to receive the HPV vaccine. Emotional support for the vaccine is similar to when Hispanics receive family support, promoting better health behavior. This includes but is not limited to the following: anti-smoking (Escobedo et al., 2018; Kaplan et al., 2001), alcohol misuse (DiBello et al., 2016; Dillon et al., 2013), treatment adherence (Hosch et al., 1995; Johnson et al., 2008b; Lange et al., 2009), cancer screening (Bazargan et al., 2004; Otero-Sabogal et al., 2003; Teran et al., 2007), and

sexual risk behavior (Benavides et al., 2006). Similar research findings have mentioned that having a partner's approval and having a friend's approval were positively associated with receiving the HPV vaccine (Bendik et al., 2011). Roommates, friends, and sexual partners also influence college women's attitudes and perspectives towards HPV vaccination (Allen et al., 2009; Hopfer & Clippard, 2011; Kahn et al., 2003; Kahn et al., 2008a, 2008b). It is evident that getting support is beneficial and a cost-effective approach to prevention despite one's economic status (Rice, 2012). Emotional support provides comfort and is a way of sharing or reducing stress (Kuuppelomäki, 2003; Langford et al., 1997; Wills, 1985). It influences health by encouraging the adaptation of healthy (or unhealthy) behaviors that adhere to social norms. Previous research found that different types of support, including financial, logistical, informational, and injunctive norms, positively impact participants' ability to get the vaccine (Hopfer & Clippard, 2011). This study was not able to capture the impact of different kinds of support (e.g., financial, logistic) on HPV vaccine uptake, which needs to be explored extensively in the future. From a preventative perspective, there is an urgent need to identify and develop culturally appropriate and cost-effective support systems (Baron & Kenny, 1986; Rice, 2012).

The study results indicate differences in study sites and how cultural factors (cancer fatalism and traditional gender roles) were associated with vaccine uptake. One potential explanation for the site differences could be the imbalance in the proportions of individuals of Hispanic origin at both sites. Most of the participants in FIU were from Cuba and Puerto Rico, whereas most of the

participants in UH were from Mexico. Even though Hispanics were represented in the entire population, differences in cultural values and norms inherent in the groups may play a major role in this study's findings. Another potential factor could be the size of the Hispanic population at each site. Miami has a larger Hispanic community compared to Houston. Therefore, it is likely that the participants in Miami maintain traditional Hispanic cultural norms more than participants in Houston. Relative to Miami, Houston has a more diverse population, which may afford participants more opportunities to socialize with individuals from other cultures, thereby, influencing their level of acculturation and impact of the traditional gender roles.

LIMITATIONS

Several limitations need to be considered while interpreting the results from this study. First, a convenience sample was used, which compromised the generalizability of the study's findings and could introduce selection bias. Second, data were collected through a cross-sectional study, so it was not possible to confirm whether or not individuals who initiated the vaccine completed the series at a later time. Due to the cross-sectional study design, conducting mediation analyses to assess the relationship between the predictors and vaccine uptake was not feasible. Third, this study was conducted among female Hispanic emerging adults, which limited the capacity to measure the difference in the study findings by gender (e.g., male vs. female). Fourth, the survey was only available in the English language, which may impact the participant's interpretation of the questions. Another limitation of this study is that self-reported measures have been used to capture the information, including HPV vaccination status. This could lead to recall or social desirability biases, however, confirming HPV vaccine uptake from medical records would provide a more unbiased measure of vaccination. The study collected information regarding the insurance status of the participants, but it failed to ask whether or not the vaccination was covered by their insurance, by their parent's insurance, or by state-funded programs. The study's findings suggest that the effect size may have underestimated vaccine uptake and requires further study. Finally, the research findings are not representative of all college students in the U.S., as the participants were all Hispanic and female.

STRENGTHS

To the best of our knowledge, this is one of the few studies to examine the associations between sociocultural factors and HPV vaccine uptake among Hispanic emerging adults. This study contributes to closing a research gap on the roles of cultural influence and preventative health practices and how they could differ by Hispanic origin and by study site. The study also investigated item-level knowledge gaps on HPV and the HPV vaccine. Finally, this was the first study to examine the moderating effect of acculturation on the association between traditional gender roles and HPV vaccine uptake as well as the moderating effect of HPV knowledge and HPV vaccine knowledge on the association between cancer fatalism and vaccine uptake.

CONCLUSION

In the United States, HPV is a major public health concern. Despite an increase in HPV vaccine coverage over the past decade, many adolescents and emerging adults remain unvaccinated. Given that vaccine uptake among emerging adults is low, culturally appropriate interventions are crucial for eradicating HPV burdens. Due to the complexity of the HPV vaccination decision-making process, it is equally critical to understand the HPV vaccine facilitators. This study's findings suggest an association between sociocultural factors and HPV vaccine uptake. The findings also imply that modifiers such as HPV knowledge, HPV vaccine knowledge, and acculturation should be investigated further in order to better understand their impact on the causal pathway of Hispanic cultural factors and vaccine uptake. Identifying and comprehending modifiable factors will boost vaccine uptake. Finally, a culturally tailored intervention is needed to enhance vaccine uptake and to protect emerging adults against future HPV-related cancers. Interventions, which include peer educators for emerging adults as well as educational interventions for healthcare personnel, are needed to ensure that emerging adults receive the vaccine. The HPV vaccine should be prioritized and extensively advertised for eligible emerging adults in order to prevent cancer inequalities.

IMPLICATIONS

The proposed dissertation has made a significant contribution to this field of HPV cancer prevention. The study identified underlying cultural factors that may impact emerging adults' HPV vaccination rates. The study has helped to obtain a better understanding of how raising knowledge about HPV and the HPV vaccine can assist in minimizing cancer fatalism and could improve HPV vaccine uptake. In addition to that, the study has increased our knowledge of how traditional gender roles can play a crucial role in the decision-making process for HPV vaccine uptake. Furthermore, significant progress has been made in terms of understanding the association between familism and HPV vaccine uptake. Sociocultural factors are understudied, yet they may have an important role in increasing vaccination rates. Finally, identifying sociocultural determinants will assist in the future development of culturally appropriate and evidence-based interventions for Hispanic emerging adults to prevent HPV-associated cancers and genital warts.

RECOMMENDATIONS

The HPV vaccine is the key to eliminating HPV-related cancer disparities. However, the availability of the vaccine does not ensure successful vaccine uptake. Considering the growing prevalence of HPV-associated morbidities and mortalities, initiatives should be taken both at the institutional level and national level.

At the institutional level, future research should consider focusing on how university health care centers could play a vital role in the elimination of HPV burdens alongside public health professionals, cancer prevention activists, and healthcare providers. First, healthcare personnel at campus clinics should be trained to offer the vaccine to emerging adults. Second, on-campus healthcare centers might arrange informative sessions on vaccinations for the students. Third, at orientation, college students should be given information on HPV and the HPV vaccine, including where they may receive the vaccine (e.g., campus health center) and no cost vaccination programs. Fourth, since the knowledge about HPV and the HPV vaccine is still low, culturally appropriate intervention programs aimed at Hispanic emerging adults should be developed to increase their knowledge via peer educators. Fifth, future studies should also include a qualitative research component to better understand the cultural differences and their impact on vaccine uptake. Finally, future research should include male participants in order to investigate gender differences in sociocultural factors and HPV vaccine uptake.

Several approaches should be recommended at the national level to boost vaccine uptake among emerging adults. First, similar to the Healthy People 2030's goal for adolescents, HPV vaccine uptake for emerging adults should have a national goal of achieving 80% or higher. Second, the government should establish national campaigns to promote HPV vaccination (e.g. National HPV Vaccination Day) nationwide. Third, to reduce the economic burden of HPV, incentive programs for emerging adults to get the vaccine should be proposed.

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PUBLICATIONS AND PRESENTATIONS (Selected)

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